

**Utah Department of Transportation**



**Supplemental Specifications  
for**

**2005 Standard  
Specifications**

**FOR ROAD AND BRIDGE  
CONSTRUCTION**

**U.S. Standard Units (Inch-Pound Units)**

**Issued July 16, 2007**

# Memorandum

UTAH DEPARTMENT OF TRANSPORTATION

**DATE:** July 16, 2007

**TO:** Holders of Hard Copy of Standard Specifications

**FROM:** Barry Axelrod, CDT  
Standards and Specifications

**SUBJECT:** Supplemental Specifications Distribution, dated July 16, 2007

Applicable files for the change are attached. Maintain these files as a supplemental update to the UDOT Standard Specifications dated January 1, 2005. No pages are to be removed or replaced in the basic book, electronic or hard copy.

If you are in need of electronic copies of any Standard or Supplemental Specification please refer to the Standards and Specifications Web site at <http://www.udot.utah.gov/go/standardsandspecifications>. From there select the **2005 Standards** subtopic.

Please note that the 2005 Standards are still in effect. The next version of the Standards is planned for 2008.

If you have any questions or problems with the electronic files contact me at 801-964-4570 or by email at [baxelrod@utah.gov](mailto:baxelrod@utah.gov).

Attachments

## **Listing of Supplemental Specifications**

### **Issue Date: March 14, 2005**

Revised February 24, 2005

Section 01282M Article 1.1 Paragraph D added and Article 1.14 Paragraph E replaced.

Section 01284 New section added

Section 02785M Replaces Table 1 to correct reference callout from AASHTO to ASTM

Section 02843 Entire section revised.

Section 06055M Article 1.2 Paragraph F added and Article 2.2 Paragraphs A and D modified.

### **Issue Date: May 10, 2005**

Revised April 28, 2005

Section 02827 New section added

### **Issue Date: July 12, 2005**

Revised June 30, 2005

Section 02745 Entire section revised.

Section 03412M Article 1.3 revised, Article 1.4 Paragraph E added, Article 1.5 Paragraph C added, and Article 3.7 added.

Section 05120 M Article 1.3 revised, Article 1.4 Paragraph D added, and Article 3.5 added.

### **Issue Date: September 12, 2005**

Revised August 25, 2005

Section 01452M Article 3.1 Paragraph B item 1 replaced.

Section 01571 Entire section replaced.

Section 01574M Article 1.1 replaced, Article 1.3 Paragraph B added, and Article 3.1 Paragraphs F and G added.

Section 01721M Article 1.2 replaced.

Section 02842M Article 1.3 Paragraph C and Article 2.1 Paragraph A replaced.

Section 13551M Article 1.3 replaced, Article 2.1 replaced, Article 3.3 Paragraph C replaced, Article 3.5 Paragraph C replaced, and Article 3.5 Paragraph D added.

Section 13552M Article 1.1 Paragraph A replaced, Article 1.3 replaced, Article 2.2 through Article 2.6 replaced, Article 2.8, Paragraph C added, and Article 3.2 replaced.

Section 13553M Article 1.2 paragraphs I and J replaced, Article 1.3 replaced, Article 2.1 Paragraphs H and I replaced, Article 3.1 Paragraph F replaced, Article 3.1 Paragraph Q3 replaced, Article 3.2 Paragraph A replaced, Article 3.3 Paragraph F replaced, Article 3.4 Paragraph C added, and Article 3.5 Paragraph C added.  
Section 13554M Article 2.2 replaced and Article 3.1 Paragraph N through H replaced.  
Section 13555M Article 1.3 Paragraph E added, Article 2.1 Paragraph A replaced, Article 3.1 Paragraph D deleted, Article 3.2 Paragraphs C, G, and H replaced, Article 3.4 replaced, and Article 3.6 Paragraphs A and B replaced.  
Section 13556 Entire section revised.  
Section 13561M Article 2.1 Paragraph K added, Articles 3.1 Paragraphs E through G replaced, and Article 3.2 Paragraph A replaced.  
Section 13594M Article 2.3 Paragraph A replaced, Article 2.3 Paragraph C replaced, Article 2.4 replaced.

## **Issue Date: November 9, 2005**

Revised October 27, 2005

Section 00725M Article 1.2, paragraph B added, Article 1.4 replaced.  
Section 02745 Entire section originally revised July 12, 2005. This change corrected error in Table 13, Float Test.

## **Issue Date: March 2, 2006**

Revised February 23, 2006

Section 00555M Article 1.6, paragraph A replaced.  
Section 00725M Article 1.2, paragraph B added, Article 1.4 replaced, Article 1.18 Paragraph C1 added, article 1.18 Paragraph D replaced, and Article 1.18 Paragraphs E – I replaced. **(Replaces Supplemental Specification 00725M issued November 9, 2005.)**  
Section 00820M Article 1.2 replaced, Article 1.15 replaced, and Article 1.16 replaced.  
Section 01280M Article 1.3 replaced and Article 1.10 deleted.  
Section 01574M Article 1.1 replaced, Article 1.3 Paragraph B added, Article 1.4, paragraph B1 added, Article 3.1 Paragraphs F and G added, and Article 3.4, paragraph A replaced. **(Replaces Supplemental Specification 01574M issued September 12, 2005.)**  
Section 01721M Article 1.1, Paragraph A replaced, Article 1.2 replaced, Article 1.5, Paragraph F and G replaced, Article 3.3, Paragraph C deleted, and Article 3.11 replaced. **(Replaces Supplemental Specification 01721M issued September 12, 2005.)**  
Section 02317 Entire section revised.  
Section 02748M Article 2.1, Paragraph A replaced, Article 2.2, Paragraph A replaced, and Article 3.2 replaced.

## **Issue Date: May 2, 2006**

Revised April 27, 2006

Section 02633 New section added.

Section 13557 Entire section revised. Title changed.

## **Issue Date: July 11, 2006**

Revised June 29, 2006

Section 01452M Article 1.5, paragraph B replaced, Article 3.1 Paragraph B item 1 replaced, and Table 1 replaced.

Section 01455 Entire section revised.

Section 01561 Deleted by change to Section 01571.

Section 01571 Entire section revised. Deleted Sections 01561 and 01574.

Section 01574 Deleted by change to Section 01571.

Section 02610 Entire section revised.

Section 02645 Entire section revised. Title changed.

Section 02896M Article 3.1, paragraph A replaced, Article 3.3, paragraph C7 added, and Article 3.3, paragraph E replaced.

## **Issue Date: September 11, 2006**

Revised August 31, 2006

Section 02373M Article 1.3, Paragraph C deleted and Article 2.1 replaced.

Section 02613 Entire section revised.

Section 02741M Table 6 replaced.

Section 02785 Entire section revised. Replaced Supplemental Specification 02785M.

Section 02969 Entire section revised.

Section 03311M Table 1 replaced.

Section 03412M Article 3.2, Paragraph E replaced. Previously issued Supplemental Specification incorporated.

## **Issue Date: December 18, 2006**

Revised November 30, 2006

Section 00555 Entire section revised. Replaced Supplemental Specification 00555M.

Section 00570 Entire section revised.

Section 00725 Entire section revised. Replaced Supplemental Specification 00725M.

Section 00727 Entire section revised.

Section 01282 Entire section revised. Replaced Supplemental Specification 01282M.

Section 01284 Replaces previously issued Supplemental Specification that added Section 01284. Article 1.2, Paragraph B modified and Paragraph D deleted.

Section 01561 Section deleted per Supplemental Specification 01571 issued July 11, 2006. Delayed issue, Supplemental for Section 01561 not previously issued.

Section 01574 Section deleted per Supplemental Specification 01571 issued July 11, 2006. Delayed issue, Supplemental for Section 01574 not previously issued.

Section 02056 Entire section revised. Name of section changed and Sections 02061, 02324, and 02330 deleted.

Section 02061 Section deleted per Supplemental Specification 02056.

Section 02324 Section deleted per Supplemental Specification 02056.

Section 02330 Section deleted per Supplemental Specification 02056.

Section 02844 Entire section revised.

## **Issue Date: March 8, 2007**

Revised February 22, 2007

Section 01284 Replaces previously issued Supplemental Specification that added Section 01284 and one that modified Article 1.2, Paragraph B and deleted Paragraph D. Latest change Article 1.4, Paragraph A replaced.

Section 02754 Entire section revised.

Section 02765 Entire section revised.

Section 02843 Entire section revised.

Section 02892 Entire section revised.

Section 13551 Entire section revised. Replaced Supplemental Specification 13551M.

Section 13552M Articles 1.1, Paragraph A, 1.3, 1.4, 2.2 - 2.6, 3.1, Paragraph A, C, and F, 3.2, 3.4 Paragraph C, 3.8, Paragraphs B - E, 3.9, Paragraphs B and C, and 3.11, Paragraph B replaced. Article 2.7, Paragraph B deleted, and Article 2.8, Paragraph C added.

Section 13553 Entire section revised. Replaced Supplemental Specification 13553M.

Section 13554 Entire section revised. Replaced Supplemental Specification 13554M.

Section 13555M Articles 1.2, 1.3, Paragraph E, 2.1, Paragraph A, 2.2, Paragraph B, 2.7, 3.1, Paragraph C, 3.2, 3.3, Paragraph E, 3.4, and 3.6, Paragraphs A and B replaced. Article 2.4, Paragraph B and 3.3, Paragraph F added. Article 3.1, Paragraph D deleted.

Section 13561 Entire section revised. Replaced Supplemental Specification 13561M.

Section 13591M Articles 3.1, Paragraph A, 3.2, Paragraphs D, E, and G, 3.3, Paragraphs A, E, F, I, and J, and 3.4, Paragraphs A and B replaced. Articles 1.3, Paragraph B and 3.3, Paragraph L deleted.

Section 13592 Entire section revised.

Section 13594 Entire section revised. Replaced Supplemental Specification 13594M.

Section 13595 Entire section revised.

## **Issue Date: May 10, 2007**

Revised April 26, 2007

- Section 00120 Entire section revised.
- Section 00515 Entire section revised.
- Section 00820 Entire section revised. Replaced Supplemental Specification 00820M.
- Section 01280 Entire section revised. Replaced Supplemental Specification 01280M.
- Section 01452 Entire section revised. Replaced Supplemental Specification 01452M.
- Section 02056 Entire section revised. Replaced Supplemental Specification 02056.
- Section 02332 Section deleted per Supplemental Specification 02056.
- Section 02455 Entire section revised.
- Section 02466 Entire section revised.
- Section 02721 Entire section revised.
- Section 02746 Entire section revised.
- Section 02749 Section deleted.
- Section 02754 Entire section revised. Replaced Supplemental Specification 02754.
- Section 02785 Entire section revised.
- Section 02891 Entire section revised.
- Section 02982 Entire section revised.
- Section 03575 Entire section revised.

## **Issue Date: July 16, 2007**

Revised June 28, 2007

- Section 02373M Article 2.1, paragraph C replaced. Replaced Supplemental Specification 02373M.
- Section 02721 Entire section revised. Replaced Supplemental Specification 02721.
- Section 02786 Entire section revised.
- Section 03055 Entire section revised.
- Section 03211 Entire section revised.
- Section 03310 Entire section revised.
- Section 03339 Entire section revised.
- Section 03390 Entire section revised.
- Section 03392 Entire section revised.
- Section 05120 Entire section revised. Replaced Supplemental Specification 05120M

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**SECTION 02373M**

**RIPRAP**

**Delete Article 2.1, Paragraph C and replace with the following:**

- C. Maximum 16 percent weighted loss per AASHTO T 104. Testing may be waived by the Engineer based on previous history or testing with the proposed aggregate source.

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**SECTION 02721**

**UNTREATED BASE COURSE (UTBC)**

**Delete Section 02721 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Production, construction, and compaction of UTBC used for pavements, shoulders, and incidental construction.

**1.2      RELATED SECTIONS**

- A.      Section 01572: Dust Control and Watering

**1.3      REFERENCES**

- A.      AASHTO T 11: Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
- B.      AASHTO T 19: Bulk Density ("Unit Weight") and Voids in Aggregate
- C.      AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates
- D.      AASHTO T 89: Determining the Liquid Limit of Soils
- E.      AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils
- F.      AASHTO T 96: Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- G.      AASHTO T 180: Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and 457 mm (18 in) Drop
- H.      AASHTO T 193: The California Bearing Ratio
- I.      AASHTO T 255: Total Evaporable Moisture Content of Aggregate by Drying

- J. AASHTO TP 61: Determining the Percent of Fracture in Coarse Aggregate
- K. UDOT Minimum Sampling and Testing Requirements

#### **1.4 SUBMITTALS**

- A. Submit a written report for approval for each aggregate class and source, a minimum of five working days prior to placement. Include the following:
  - 1. Aggregate suitability. Refer to this Section, Part 2, Products.
  - 2. Name of supplier and location of source.
  - 3. Maximum Dry Density and Optimum Moisture Content. Refer to AASHTO T 180, Method D.
  - 4. Job mix gradation including single values for each sieve size, No. 4 and finer, within the gradation limits of Table 2.

#### **1.5 ACCEPTANCE**

- A. Acceptance sampling and testing of material is in accordance with UDOT Minimum Sampling and Testing Requirements.
- B. Type I Placement – Pavement Section (Includes placement for Curb or Curb and Gutter when in conjunction with placement for pavement section.)
  - 1. Use Class A aggregate, Table 1.
  - 2. The Engineer takes random samples from the grade and tests for moisture, gradation, and laboratory density, and performs In-place Density determinations.
  - 3. Meet gradation limits and applicable tolerances of Table 2 for each gradation test. Each subplot will be evaluated separately and not averaged with other sublots.
  - 4. Meet minimum density test average of 97 percent of maximum laboratory density with no test less than 94 percent.
- C. Type II Placement – Incidental (Includes placement for Curb, Curb & Gutter, Driveways, Pedestrian Access Ramps, Sidewalk, Waterways, Flatwork, and other items of work in the contract to which UTBC is included and not measured or paid for separately.)
  - 1. Use Class A or B aggregate, Table 1.
  - 2. The Engineer takes random samples from the grade and tests for moisture, gradation, and laboratory density, and performs In-place Density determinations.
  - 3. Meet gradation limits and applicable tolerances of Table 2 for each gradation test. Each subplot will be evaluated separately and not averaged with other sublots.

4. Meet minimum density test average of 95 percent of maximum laboratory density with no test less than 92 percent.
- D. Type III Placement – Shoulder
    1. Use Class A, B or C aggregate, Table 1.
    2. Adjust moisture content prior to compaction.
  - E. Material not meeting the gradation requirements may be allowed to remain in-place at the discretion of the Engineer, provided density requirements are met. However, additional lots may not be placed until the deficiencies are addressed and corrected.
  - F. When directed by the Engineer, correct material that does not meet the specified criteria by scarifying, placing additional material, re-mixing, reshaping and re-compacting. Rework unacceptable material at no additional cost to the Department.
  - G. Do not place additional material on any unaccepted layer.
  - H. When directed by the Engineer, remove products found defective after placement and replace with acceptable products at no additional cost to the Department

## **PART 2 PRODUCTS**

### **2.1 AGGREGATES**

- A. Well-graded, clean, hard, tough, durable and sound mineral aggregates consisting of crushed stone, crushed gravel or crushed slag; free of organic matter and contamination from chemical or petroleum products; meeting the requirements of Table 1.

**Table 1**

<b>Aggregate Properties</b>				
	<b>Aggregate Class</b>			
	<b>A</b>	<b>B</b>	<b>C</b>	
Dry Rodded Unit Weight	Not less than 75 lb/ft <sup>3</sup>			AASHTO T 19
Liquid Limit/ Plastic Index	Non-plastic		PI ≤ 6	AASHTO T 89 AASHTO 90
Aggregate Wear	Not to exceed 50 percent.			AASHTO T 96
Gradation	Table 2			AASHTO T 11 AASHTO T 27
CBR with a 10 lb surcharge measured at 0.20 inch penetration	70% Minimum		N/A	AASHTO T 193
Two Fractured Faces	50 % Min	N/A	N/A	AASHTO TP 61

- B. Establish the job mix (target) gradation for the ¾ inch sieve and finer within the gradation limits. The Job Mix Gradation Tolerance is the allowable deviation from the job mix (target) gradation on the applicable sieves. All other percents passing will be within the gradation limits. Refer to AASHTO T 11 and AASHTO T 27.

**Table 2**

<b>Gradation Limits</b>		
<b>Sieve Size</b>	<b>Job Mix Gradation Target Band</b>	<b>Job Mix Gradation Tolerance</b>
1-1/2 inch	100	
1 inch	90 - 100	±9.0
3/4 inch	70 - 85	±9.0
1/2 inch	65 - 80	±9.0
3/8 inch	55 - 75	±9.0
No. 4	40 - 65	±7.0
No. 16	25 - 40	±5.0
No. 200	7 - 11	±3.0

Percent passing based on total aggregate (dry weight), and fine and coarse aggregate having approximately the same bulk specific gravities.

## **PART 3      EXECUTION**

### **3.1      INSTALLATION**

- A.    Mixing: Provide moisture content of  $\pm 2$  percent of optimum at the time of placement. Refer to AASHTO T 180, Method D and AASHTO T 255.
- B.    Procedures for changing the Job-Mix Gradation
  - 1.     Submit changes in writing 24 hours prior to placement for approval by the Engineer.
- C.    Placing: Place in layers of uniform thickness and compact each layer to a thickness not to exceed a 6 inch depth. Do not place on any frozen surface. Refer to Section 01572.
- D.    Finishing: Uniform line and grade with surface deviations no more than  $\frac{3}{8}$  inch in 10 ft in any direction.
  - 1.     Profile Tolerance — Correct any profile deviations greater than  $\frac{3}{8}$  inch.
    - a.     Rework minimum of 4-inch lift to achieve homogeneous density.
    - b.     Determine limits of correction based on extent of deviation.
    - c.     Continue finishing until existing deviation is less than  $\frac{3}{8}$  inch.
- E.    Compaction: Maintain optimum moisture content  $\pm 2$  percent.
  - 1.     Use appropriate compaction equipment adjacent to abutments, backwalls, approach slabs, wing walls, retaining walls, and other structures.
  - 2.     Use a minimum of 2 passes with a roller for Type III placement or as directed by the Engineer.

END OF SECTION

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**SECTION 02786**

**OPEN-GRADED SURFACE COURSE (OGSC)**

**Delete Section 02786 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Materials and procedures for constructing OGSC.

**1.2      RELATED SECTIONS**

- A.      Section 01452: Pavement Smoothness
- B.      Section 02745: Asphalt Material
- C.      Section 02746: Hydrated Lime
- D.      Section 02748: Prime Coat/Tack Coat

**1.3      REFERENCES**

- A.      AASHTO T 30: Mechanical Analysis of Extracted Aggregate
- B.      AASHTO T 89: Determining the Liquid Limit of Soils
- C.      AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils
- D.      AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine
- E.      AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- F.      AASHTO T 112: Clay Lumps and Friable Particle in Aggregate

- G. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
- H. AASHTO T 278: Surface Frictional Properties Using the British Pendulum Tester
- I. AASHTO T 279: Accelerated Polishing of Aggregates Using the British Wheel
- J. AASHTO T 304: Uncompacted Void Content of Fine Aggregate
- K. AASHTO T 308: Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method
- L. AASHTO TP 61: Determining the Percentage of Fractured Particles in Coarse Aggregate
- M. UDOT Quality Management Plans
- N. UDOT Materials Manual of Instruction
- O. UDOT Minimum Sampling and Testing Requirements

#### **1.4 SUBMITTALS**

- A. Job mix gradation: at least 10 working days before paving.
  - 1. Submit materials and documentation in accordance with Materials Manual of Instruction, Section 954.
  - 2. Aggregate suitability test results.
- B. Changes in job mix gradation:
  - 1. Submit a written request for a change in a job-mix gradation.
  - 2. Allow the Engineer five working days to review and approve the changes and to readjust the quantity of asphalt binder to be used.
- C. Verification that Hydrated Lime meets the requirements of 02746.
- D. Verification Asphalt Binder meets the requirements of 02745.

#### **1.5 ACCEPTANCE**

- A. Acceptance sampling and testing of material is in accordance with UDOT Minimum Sampling and Testing Requirements.

- B. A lot equals the number of tons placed during each production day.
1. A lot is evaluated on the test results of four samples, with the following exceptions:
    - a. If only three samples can be taken for the production day; compute incentive/disincentive using the test results from three samples.
    - b. Add the lot to the next day's production if three random samples cannot be taken.
    - c. Add the lot to the previous day's production for the last day's production if three random samples cannot be taken.
    - d. When less than 900 tons are anticipated per production day, the lot may be increased to include up to three production days, when agreed upon in advance by both the Contractor and the Engineer.
    - e. Evaluate with the appropriate number of tests "n" in Table 4:
  2. Asphalt Binder: Department will compute incentive/disincentive for asphalt binder content based on Table 1 using the single test result with the largest deviation from the target. AASHTO T 308.
    - a. Apply incentive to the entire lot.
    - b. Disincentive is applied only to the subplot (defined as percentage of the lot represented by the test).
    - c. Any lot that includes one or more sublots in disincentive is not eligible for incentive
  3. Gradation: Department will compute incentive/disincentive for gradation is based on Percent Within Limits computation using Table 2, 3, 4, and 5. AASHTO T 30
    - a. The Department will reject the lot if the Percent Within Limits is less than 60 percent.
  4. Any lot rejected based on either gradation or asphalt binder content will not be eligible for any incentive.
- E. Thickness
1. Verify the thickness with a depth probe and take corrective action if necessary.
    - a. Minimum thickness: Plan depth minus ¼ inch.
- F. Smoothness
1. Determine acceptance and correct in accordance with Section 01452.
- G. Submit an engineering analysis within one week, if requesting that a rejected lot or subplot remain in place.
1. Include in the analysis: Data and engineering principles that indicate why the pavement should remain in place.
  2. The Engineer, Region Materials Engineer, and District Engineer review the analysis for acceptance, denial, or revision within three working days.
  3. If the request is denied, remove the rejected material from the project within 72 hours and replace it with an acceptable material.

4. If rotomilling is required, agree on removal time period.
5. Department deducts \$20/ton if a rejected lot or subplot is allowed to remain in place.

**Table 1**

<b>Incentive/Disincentive for Binder Content</b>	
<b>Binder Content</b>	<b>Pay Adjustment in \$/ton OGSC</b>
Within $\pm 0.30\%$ of target	+1.00
Between $\pm 0.31\%$ and $\pm 0.45\%$ of target	0.00
Between $\pm 0.46\%$ $\pm 0.60\%$ of target	-2.00
Greater than $\pm 0.61\%$	Reject

**Table 2**

<b>Gradation Upper and Lower Limit Determination</b>	
<b>Parameter</b>	<b>UL and LL</b>
$\frac{3}{8}$ inch sieve	Target Value $\pm 6.0$ percent
# 4 sieve	Target Value $\pm 6.0$ percent
# 8 sieve	Target Value $\pm 5.0$ percent
# 200 sieve	Target Value $\pm 2.0$ percent

**Table 3**

<b>Incentive/Disincentive for Gradation</b>	
<b>Gradation</b>	
<b>PT</b>	<b>Incentive/Disincentive (Dollars/Ton)</b>
> 99	1.50
96-99	1.00
92-95	0.60
88-91	0.00
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject

**Table 4**

<b>Quality Index Values for Estimating Percent Within Limits</b>										
<b>PU/PL</b>	<b>n=3</b>	<b>n=4</b>	<b>n=5</b>	<b>n=6</b>	<b>n=7</b>	<b>n=8</b>	<b>n=10</b>	<b>n=12</b>	<b>n=15</b>	<b>n=20</b>
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
<60	≤ 0.35	≤ 0.29	≤ 0.27	≤ 0.26	≤ 0.25	≤ 0.25	≤ 0.24	≤ 0.24	≤ 0.24	≤ 0.24

Enter table in the appropriate “number of tests” column and round down to the nearest value.

**Table 5**

<b>Definitions, Abbreviations, and Formulas for Acceptance</b>	
<b>Term</b>	<b>Explanation</b>
Target Value (TV)	The target values for gradation and asphalt binder content.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Sample Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	$QU = (UL - AVE)/s$
Lower Quality Index (QL)	$QL = (AVE - LL)/s$
Percentage of Lot Within UL (PU)	Determined by entering Table 4 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 4 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	$PT = (PU + PL) - 100$
Incentive/Disincentive	Determined by entering Table 3 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to at least a two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

## **PART 2      PRODUCTS**

### **2.1      ASPHALT MATERIAL**

- A.      As specified, in Section 02745.
- B.      Sampling procedure: UDOT Quality Management Plan - 509 Asphalt Binder.

### **2.2      HYDRATED LIME**

- A.      Meet the requirements of Section 02746.

### **2.3      AGGREGATE MATERIALS**

- A.      Crusher processed virgin aggregate material consisting of crushed stone, gravel, or slag.

- B. Meet the following requirements, including Table 6, to determine the acceptability of the aggregate.
1. Coarse aggregate:
    - a. Retained on # 4 sieve.
  2. Fine aggregate:
    - a. Clean, hard grained, and angular.
    - b. Passing the # 4 sieve.

**Table 6**

<b>Aggregate Properties</b>		
<b>Properties</b>	<b>Test Method</b>	<b>Test Requirement</b>
One Fractured Face	AASHTO TP 61	95 percent min.
Two Fractured Face	AASHTO TP 61	90 percent min.
Fine Aggregate Angularity	AASHTO T 304	45 min.
Flakiness Index	UDOT MOI 933	20 % max.
L.A. Wear	AASHTO T 96	30 % max.
Sand Equivalent	AASHTO T 176	60 min.
Plasticity Index	AASHTO T 89 and T 90	0
Polish Test	AASHTO T 278 & T 279	31 min.
Soundness (sodium sulfate)	AASHTO T 104	12 % max. loss with five cycles
Clay Lumps and Friable Particles	AASHTO T 112	2 % max.
Natural Fines	None	None

## 2.4 JOB-MIX

- A. Obtain Engineer's approval for job mix gradation:
1. Show definite single values for the percentage of aggregate passing each sieve based on the dry weight of aggregate.
  2. Stay within the single value gradation limits of Table 7.
  3. Incorporate minimum hydrated lime by dry weight of aggregate into all mixtures. Refer to Section 02746:
    - a. Method A, Lime Slurry incorporate 1 percent
    - b. Method B, Lime Slurry Marination incorporate 1½ percent
- B. Binder Content
1. The Engineer determines the binder content. MOI Section 954.

**Table 7**

<b>Aggregate Gradation</b>	
<b>(Percent Passing by Dry Weight of Aggregate)</b>	
<b>Sieve Size</b>	<b>Percent</b>
1/2 inch	100
3/8 inch	90 - 100
# 4	35 - 45
# 8	14 - 20
# 200	2 - 4

## **PART 3 EXECUTION**

### **3.1 MIXING**

- A. Mix until all particles are coated.
- B. Treat aggregate with hydrated lime in accordance with the requirements of 02746.
  - 1. When using Method A, verify lime slurry equipment is operating at all times.
    - a. Cease production if hydrated lime slurry treatment is interrupted.
    - b. Engineer may require marination of the aggregate/hydrated lime mixture in the stockpile, Method B, if production continues without hydrated lime slurry treatment.

### **3.2 SURFACE PLACEMENT**

- A. Apply the tack coat at a uniform rate. Refer to Section 02748.
  - 1. 0.10 gal/yd<sup>2</sup> on new pavement
  - 2. 0.15 gal/yd<sup>2</sup> on milled surfaces
- B. Maintain a steady paver speed
- C. Roll sufficiently to seat without fracturing aggregate.
- D. Bring all passes up even transversely at the end of each working day.
- E. Construct longitudinal joints within 6 inches of lane lines.
- F. Remove slick spots as directed by the Engineer.

### **3.3 LIMITATIONS**

- A. Place between May 1 and September 15.
  - 1. Obtain written approval from the Engineer before placing OGSC after September 15.
- B. Place when the air temperature in the shade and the pavement surface temperature are above 60 degrees F and rising.
- C. Do not place if surface moisture is present.
- D. Do not place during rain or during other adverse weather conditions.

END OF SECTION

**Supplemental Specification  
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**SECTION 03055**

**PORTLAND CEMENT CONCRETE**

**Delete Section 03055 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Materials and procedures for producing Portland Cement Concrete.

**1.2      RELATED SECTIONS**

- A.      None.

**1.3      REFERENCES**

- A.      AASHTO M 6: Standard Specification for Fine Aggregate for Portland Cement Concrete
- B.      AASHTO M 80: Standard Specification for Coarse Aggregate for Portland Cement Concrete
- C.      AASHTO M 154: Standard Specification for Air-Entraining Admixtures for Concrete
- D.      AASHTO M 157: Standard Specification for Ready-Mixed Concrete
- E.      AASHTO M 194: Standard Specification for Chemical Admixtures for Concrete
- F.      AASHTO M 295: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- G.      ASTM C 150: Standard Specification for Portland Cement
- H.      ASTM C 595: Standard Specification for Blended Hydraulic Cements
- I.      ASTM C 1157: Standard Performance Specification for Hydraulic Cement

- J. ASTM C 1240: Standard Specification for Silica Fume for Used in Cementitious Mixtures
- K. ASTM C 1567: Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
- L. ASTM C 1602: Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- M. American Concrete Institute (ACI) Standards
- N. Precast/Prestressed Concrete Institute (PCI)
- O. UDOT Materials Manual of Instruction
- P. UDOT Minimum Sampling and Testing Requirements Manual
- Q. UDOT Quality Management Plan

#### **1.4 SUBMITTALS**

- A. Furnish to the Engineer a mix design for each class of concrete to be used.
  - 1. Base concrete mix designs for all “A” concrete classes on trial batch test results or on UDOT’s past project history (same materials used in previous mix designs within the past year).
  - 2. Use the same components in the trial batches that are to be used in the project including coarse and fine aggregate, water, source and type of cement, air-entraining agent, fly ash, etc., including any site-added admixtures intended to be used.
  - 3. Unless specified otherwise, do not exceed 30 percent total pozzolan in any mix.
  - 4. The Department or its representative witnesses the trial batch.
  - 5. Mix concrete (trial batches) as specified in UDOT Materials Manual of Instruction Part 8-974: Guidelines for Portland Cement Concrete Mix Design.
  - 6. Meet the following additional requirements for Self Consolidating Mixes (SCC):
    - a. Design and mix according to ACI Manual of Concrete Practice 301: Specifications for Concrete.
    - b. Provide mix specific flow and/or spread criteria.
    - c. Meet PCI – TR-6-03. A visual stability index rating of 0 – 1 is required.
    - d. Provide compressive strength data.

- e. Include documentation justifying any deviation from the aggregate operating bands required by Table 4 with the mix design for approval. Production may not begin until the deviation is approved.
- B. Verification that cement used is from a pre-qualified supplier. See this Section, article 2.1, paragraph.E.
- C. Verification that fly ash used is from a pre-qualified supplier. See this Section, article 2.5, paragraph A.1.d.

## 1.5 ACCEPTANCE

- A. Acceptance is in accordance with UDOT Minimum Sampling and Testing Requirements.
- B. When concrete is below specified strength and does not have a separate strength pay factor:
  - 1. Department may accept item at a reduced price.
  - 2. The pay factor will be applied to the portion of the item that is represented by the strength tests that fall below specified strength.
  - 3. Department will calculate the pay factor as follows (based on 28 day compressive strength):
 

<b>Psi below specified strength:</b>	<b>Pay Factor:</b>
1 – 100	0.95
101 – 200	0.90
201 – 300	0.85
301 – 400	0.80
More than 400	0.50 or Engineer may reject

## PART 2 PRODUCTS

### 2.1 CEMENT

- A. Use Type II Portland Cement, or Blended Hydraulic Cement, unless otherwise specified. (ASTM C 150, ASTM C 595, ASTM C 1157)
- B. Portland Cement
  - 1. Follow Tables 1 and 3 in ASTM C 150.
  - 2. Follow the requirements of Table 2 of ASTM C 150 for low-alkali cement.

- C. Blended Hydraulic Cement.
  - 1. When Blended Hydraulic Cement is substituted for Portland Cement
    - a. Use ASTM C 1567 to verify that expansion is less than 0.1 percent at 16 days.
    - b. Refer to the equivalent cements listed in Table 1.
  - 2. When adding flyash to a blended hydraulic cement ensure that the 30 percent total pozzolan limit is not exceeded.
    - a. Submit documentation of the total pozzolan content with the mix design.

**Table 1**

<b>Portland Cement/Blended Hydraulic Cement Equivalencies</b>		
<b>ASTM C 150 (Low Alkali)</b>	<b>ASTM C 595</b>	<b>ASTM C 1157</b>
Type I	IP	GU
Type II	IP (MS)	MS
Type III	-	HE
Type V	-	HS

- D. Do not use cement that contains lumps or is partially set.
- E. Use cement from the list of UDOT qualified suppliers list maintained by the UDOT Materials Quality Assurance Section.
- F. Do not mix cement originating from different sources.
- G. Do not use air-entrained cement.
- H. Department will sample and test the cement in accordance with UDOT Quality Management Plan 502: Cement.

## **2.2 AGGREGATE**

- A. Coarse Aggregate for Normal Concrete Mixes
  - 1. Use coarse aggregate meeting AASHTO M 80 physical properties. Use one of the gradations found in Table 2.
  - 2. Do not exceed 1 percent of deleterious substances as shown in AASHTO M 80, Table 2, for Class A aggregates (material finer than No. 200 sieve: maximum allowable 1 percent, exception as noted in footnote d).

**Table 2**

<b>Aggregate Gradations - Percent Passing (by weight)</b>								
<b>Aggregate or Sieve Size (inches)</b>	<b>2-1/2</b>	<b>2</b>	<b>1-1/2</b>	<b>1</b>	<b>3/4</b>	<b>1/2</b>	<b>3/8</b>	<b>No. 4</b>
2 to No. 4	100	95-100		35-70		10-30		0-5
1-1/2 to No. 4		100	95-100		35-70		10-30	0-5
1 to No. 4			100	95-100		25-60		0-10
3/4 to No. 4				100	90-100		20-55	0-10

- B. Fine Aggregate for Normal Concrete Mixes
1. Use fine aggregate meeting AASHTO M 6 physical properties. Use the gradation found in Table 3.
  2. Do not exceed 3.0 percent of deleterious substances as outlined in AASHTO M 6, Table 2, for class A aggregates, using option “b” for material finer than the No. 200 sieve (material finer than No. 200 sieve: maximum allowable 3 percent).

**Table 3**

<b>Gradation</b>	
<b>Sieve Size</b>	<b>Percent Passing (by weight)</b>
$\frac{3}{8}$ inch	100
No. 4	95 to 100
No. 16	45 to 80
No. 50	10 to 30
No. 100	2 to 10

- C. Coarse and Fine Aggregate for Self Consolidating Concrete (SCC) Mixes.
1. Combined gradations of coarse and fine aggregates must be within the bands shown in Table 4. Establish targets and production tolerances necessary to meet the requirements of Table 4.

**Table 4**

<b>Aggregate Gradations (Percent Passing by Dry Weight of Aggregate)</b>		
<b>Sieve Size</b>	<b><math>\frac{3}{4}</math> inch Operating Bands</b>	<b><math>\frac{1}{2}</math> inch Operating Bands</b>
$\frac{3}{4}$ inch	95 – 100	–
$\frac{1}{2}$ inch	65 – 95	95 – 100
$\frac{3}{8}$ inch	58 – 83	65 – 95
No. 4	35 – 65	50 – 80
No. 8	25 – 50	30 – 60
No. 16	15 – 35	20 – 45
No. 30	10 – 35	12 – 35
No. 50	5 – 20	5 – 20
No. 100	1 – 12	2 – 12
No. 200	0 – 2	0 – 2

## **2.3 WATER**

- A. Use potable water or water meeting ASTM C 1602, including Table 2.
- B. Screen out extraneous material when pumping water from streams, ponds, lakes, etc.

## **2.4 ADMIXTURES**

- A. Air Entrainment: as specified. Meet AASHTO M 154, including Section 5.
- B. Water Reducing Agents/Accelerators: The chlorides content (as Cl-) must not exceed 1 percent by weight of the admixtures. Meet AASHTO M 194.
  1. High Range Water Reducer (HRWR): Submit a written plan for approval with the trial batch that shows proper attention will be given to ingredients, production methods, handling and placing.
  2. Do not use calcium chloride.
- C. Set Retarding Admixtures: If set retarding admixtures are required due to haul times exceeding the time limitations in this Section, article 3.4, paragraph A, establish the effective life of the set-retarding admixture by trial batch.
  1. Do not exceed any manufacturer recommendations for the use of the set-retarding admixture.
  2. Do not re-dose the concrete with additional set retarding admixture.
  3. Add set retarding admixture at the batch plant at the time of initial batching operations.

4. Show on batch tickets the amount of admixture used.
  5. Time of placement is established by the trial batch and supersedes the requirements in this Section, article 3.4, paragraph A.
- D. Viscosity Modifying Admixtures.
1. Do not exceed any manufacturer recommendations for the use of the viscosity modifying admixture.
  2. Do not re-dose the concrete with additional viscosity modifying admixture.
  3. Show on batch tickets the amount of admixture used.
- E. Site-added admixtures.
1. Use admixture in the trial batch.
  2. Use pre-measured admixtures only.
  3. Record amount used on batch ticket.
  4. Rotate the drum at least 30 revolutions at the mixing speed recommended by the manufacturer.

## **2.5 POZZOLAN**

- A. Fly Ash:
1. Class F, as specified. Conform to AASHTO M 295 except table 2.
    - a. Unless specified otherwise, replace a minimum of 20 percent of the Portland cement by weight. Use the minimum cement content in the design formulas before replacement is made.
    - b. Loss on Ignition (LOI): not to exceed 3 percent.
    - c. Maximum allowable CaO content: not to exceed 15 percent.
    - d. Use fly ash from the list of UDOT pre-qualified sources maintained by the UDOT Materials Quality Assurance.
    - e. Label the storage silo for fly ash to distinguish it from cement.
    - f. Use different size unloading hoses and fittings for cement and fly ash.
  2. Fly ash may be sampled and tested for compliance at any time.
- B. Natural Pozzolan (Class N)
1. Conform to AASHTO M 295.
  2. May use instead of fly ash provided that the expansion, according to ASTM C 1567, does not exceed 0.1 percent.
- C. Silica Fume: Conform to ASTM C 1240.

## **2.6 MIX DESIGN**

- A. Do not place concrete without written approval of the mix design.

- B. Do not change the mix design without written approval.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Aggregate stockpiles:
1. Construct stockpile platforms so that subgrades are prevented from intruding into aggregates.
  2. Build stockpiles at least two days before use.
  3. Provide an operator and front-end loader to help the Engineer take aggregate samples.
  4. Aggregate may be accepted in daily increments, but not more than 30 days before use.
  5. Provide separate stockpiles for coarse and fine aggregate.
  6. Construct stockpiles to minimize segregation of aggregate.
  7. Allow washed aggregates to drain to uniform moisture content before use (12 hours minimum).

### 3.2 CONCRETE CLASSES AND MIX REQUIREMENTS

- A. Meet the requirements in Table 5.

**Table 5**

Concrete Classes and Mix Requirements							
Class	Coarse Aggregate or Sieve Size	Max. Water/Cementitious Ratio	Min. Cementitious Content (lb/yd <sup>3</sup> )	Slump (Inch) See Article G for further Criteria	Air Content Percent (%)*	Mix Design Compress $f'_{cr}$ (Psi)	28 Day Minimum Compress $f'_c$ (Psi) **
AA(AE)	2" to No. 4	0.44	564	1 to 3.5	4.0 - 7.0	5200	4000
	1-1/2" to No. 4	0.44	564	1 to 3.5	4.5 - 7.5	5200	4000
	1" to No. 4	0.44	611	1 to 3.5	5.0 - 7.5	5200	4000
	3/4" to No. 4	0.44	611	1 to 3.5	5.0 - 7.5	5200	4000
A(AE)	1-1/2" to No. 4	0.53	470	1 to 3.5	4.5 - 7.5	3900	3000
	1" to No. 4	0.53	470	1 to 3.5	4.5 - 7.5	3900	3000
	3/4" to No. 4	0.48	517	1 to 3.5	4.5 - 7.5	3900	3000
B or B(AE)		0.62	376	2 to 5	-- 3.0 - 6.0	3250	2500

\* Values listed represent in-place air content. Make necessary adjustments for impacts to air content due to placement.

\*\* For  $f'_c$  over 4000 psi, design and proportion mixes according to ACI Manual of Concrete Practice 301: Specifications for Concrete and project specific criteria.

- B. Minimum strength is based on a coefficient of variation of 10 percent, and one test below the minimum strength per 100 tests.
- C. Maximum nominal size of coarse aggregate:
  - 1. Not larger than  $\frac{1}{5}$  of the narrowest dimension between sides of forms.
  - 2. Not larger than  $\frac{1}{3}$  the depth of slabs.
  - 3. Not larger than  $\frac{3}{4}$  of the minimum clear distance between reinforcing bars or between bars and forms, whichever is least.
- D. Do not exceed water/cementitious ratio.
- E. Calculate the water/cementitious ratio (w/c) according to the following formula:
 
$$\frac{W}{C} = \frac{\text{Water}}{\text{Cement} + \text{Pozzolan}}$$
- F. When concrete is deposited in water, use 94 lb more cement per cubic yard than the design requires for concrete placed above water.
- G. Use Table 4 to determine the slump requirements when not using water-reducing admixtures or viscosity modifying admixtures.
  - 1. Slump requirements when using low range water reducers: 1 inch to 5 inches for all classes of concrete.
  - 2. Slump requirements when using high range water reducers: 4 inches to 9 inches for all classes of concrete.
  - 3. Slump requirements when using viscosity modifying admixtures: None. Meet visual stability index of 0 – 1.

### 3.3 BATCHING MATERIALS

- A. Meet AASHTO M 157.
- B. Meet the requirements of the UDOT Quality Management Plan for Ready-Mix Concrete.
- C. Hand Mixing:
  - 1. Only Class B concrete may be hand mixed.
  - 2. Hand-mixed batches cannot exceed 0.5 yd<sup>3</sup>.
  - 3. Hand mix on a watertight platform.
  - 4. Spread the aggregate evenly on the platform, and thoroughly mix in the dry cement until the mixture becomes uniform in color.
- D. Truck-Mixed Concrete (Dry-Batch):
  - 1. Do not load trucks in excess of their rated mixing capacity, or 63 percent of the drum gross volume, or less than 2 yd<sup>3</sup>.

2. The truck rating plate must be readable.

### **3.4 LIMITATIONS - GENERAL**

- A. Timing. Unless otherwise specified, place concrete:
  1. Within 90 minutes of batching when the air temperature is below 80 degrees F.
  2. Within 75 minutes of batching when the air temperature is between 80 and 85 degrees F.
  3. Within 60 minutes of batching when the air temperature is between 86 and 90 degrees F.
  4. Prior to initial set.
- B. Concrete Temperature: Unless otherwise specified, place concrete in the forms when the concrete temperature is between 50 and 90 degrees F.
- C. Pumping and Conveying Equipment
  1. Do not use equipment, or a combination of equipment and the configuration of that equipment, that causes a loss of entrained air content that exceeds one half of the range of air content allowed by specification.
  2. Contractor is responsible for verification and monitoring of air loss.

### **3.5 CYLINDER STORAGE DEVICE**

- A. Provide and maintain cylinder storage device.
  1. Maintain cylinders at a temperature range of 60 degrees F to 80 degrees F for the initial 16-hour curing period.
  2. Do not move the cylinders during this period.
  3. Equip the storage device with an automatic 24-hour temperature recorder, which continuously records on a time-temperature chart, with an accuracy of  $\pm 1$  degree F.
  4. Have the storage device available at the point of placement at least 24 hours before placement.
  5. Engineer stops placement of concrete if the storage device cannot accommodate the required number of test cylinders.
  6. Use water containing hydrated lime if water is to be in contact with cylinders.
  7. A 24-hour test run may be required.

END OF SECTION

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**SECTION 03211**

**REINFORCING STEEL AND WELDED WIRE**

**Delete Section 03211 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Materials and procedures for placing reinforcing steel and steel welded wire fabric.
- B.      Coating for reinforcing steel and steel welded wire fabric.

**1.2      REFERENCES**

- A.      AASHTO M 31: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- B.      AASHTO M 55: Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
- C.      AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- D.      AASHTO M 284: Epoxy Coated Reinforcing Bars
- E.      ASTM A 36: Carbon Structural Steel
- F.      ASTM A 767: Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
- G.      CRSI Manual of Standard Practice
- H.      UDOT Quality Management Plans

### **1.3 SUBMITTALS**

- A. Furnish Certificates of Compliance from the manufacturer.
- B. Prequalify all coatings meeting AASHTO M 284 Annex A1: Prequalification of Organic Coatings for Steel Reinforcing Bars.
  - 1. Furnish a copy of the Prequalification Test Report to the Department's Construction and Materials Division.
  - 2. Provide an 8 oz sample of the coating material from each batch in conformance AASHTO M 284 Annex A1.2.2, to the Department's Construction and Material Division.
- C. A copy of the purchase order or a detailed letter to the Engineer verifying the warehouses or fabricators of the steel reinforcing bars or welded wire reinforcement with required samples.
- D. Samples of the steel reinforcing bars or welded wire reinforcement from the fabricator's source.
  - 1. Provide three samples of each size cut to 2 ft length.
  - 2. Samples may be waived if the original contract amount is less than 4,000 lb.
  - 3. Supply test bars at no additional cost to Department.
- E. Splice Shop Drawings: Submit five sets for approval showing the proposed number and locations of each mechanical butt splice splicing.
  - 1. Submit before ordering the reinforcing steel whenever splicing requirements vary from the plans and specifications, including all lengths including splices.
- F. Submit two sample mechanical butt splices and test to destruction in the presence of the Engineer.
- G. Reinforcing Steel Shop drawings.
  - 1. Submit before ordering the reinforcing steel whenever splicing requirements vary from the plans and specifications, including all lengths including splices.

### **1.4 QUALITY ASSURANCE**

- A. The Department may witness coating processes for project work and obtains random samples by heat number and manufacturer to conduct verification testing.

- B. Prequalification:
  - 1. Epoxy Coating Suppliers: through UDOT's Quality Management Plan (QMP) - Reinforcing Steel Epoxy Coating.
  - 2. Galvanized Coating Suppliers: through UDOT's QMP - Reinforcing Steel Galvanized Coating.
  - 3. Reinforcing steel suppliers through UDOT's QMP for steel.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Do not damage the bars or the coating during handling and storage.
  - 1. Use systems with padded contact areas when handling epoxy coated bars.
  - 2. Pad all bundling bands for epoxy coated bars.
  - 3. Lift all bundles with strong-back, multiple supports, or a platform bridge.
  - 4. Do not drop or drag bars.
- B. Repair damaged bars or coating at no additional cost to the Department.
- C. Store bars above the surface of the ground on platforms, skids or other supports.
- D. Upon delivery to the project site, cover epoxy coated reinforcing steel with an opaque covering.
  - 1. Protect epoxy coated reinforcing steel, that has been partially embedded in concrete or placed in formwork and not covered by concrete, by covering with an opaque covering prior to 30 days exposure to sunlight.
  - 2. Place the opaque coverings in a manner to provide air circulation and prevent condensation on the reinforcing steel.

## **PART 2 PRODUCTS**

### **2.1 REINFORCING STEEL**

- A. Deformed billet-steel bars as specified. Meet AASHTO M 31, Grade 60

### **2.2 EPOXY AND GALVANIZED COATINGS**

- A. As specified. Meet AASHTO M 284 OR AASHTO M 111.
- B. Coat bars as shown on the plans.
  - 1. Maintain epoxy coating thickness between 8 and 12 mils.
  - 2. Maintain galvanized coating thickness as specified. ASTM A 767.
  - 3. Coat bars after bending, unless the fabricator can show that satisfactory results can be obtained by coating before bending.

4. Reject any bent bars with visible cracks or damage in the coating.

## **2.3 WIRE AND WIRE REINFORCEMENT**

- A. Cold-Drawn Steel Wire: As specified. Meet AASHTO M 55.
- B. Welded Steel Wire Reinforcement: As specified. Meet AASHTO M 55.
- C. Tie Wire: 16 gauge before coating.
  1. Use coated wire.

## **2.4 BAR SUPPORTS**

- A. Epoxy-coated, galvanized, or plastic-coated, or plastic bar supports:
  1. Meet the requirements of the “Bar Support” chart at the end of this Section.
  2. Remove contaminants that affect the adhesion of the coating to the wire.
  3. Use an electrostatic-spray method, fluidized bed, or flocking to apply an epoxy coating.
  4. Apply plastic coating by spraying, dipping, or using as a powder.
  5. Maintain galvanized coating thickness as specified. AASHTO M 111.
  6. Maintain the thickness of epoxy or plastic coatings at a minimum of 5 mils with no maximum.
  7. Use patching material per the manufacturer’s recommendation to repair damaged coating.
    - a. Use patching material that is compatible with the coating, and that is inert in concrete.
    - b. Hanger marks on the coated bar supports that result from the coating application process are acceptable and are not considered damaged coating.
- B. Precast concrete block bar supports:
  1. Minimum 28-day compressive strength of 2,500 psi
  2. Three inch thick supports with sides ranging from 4 inches to 6 inches with a minimum soil contact area of 24 in<sup>2</sup>.

## **2.5 MECHANICAL ANCHORAGE DEVICE**

- A. Splice Coupler (Same coating system as bar)
  1. Reinforcing steel splice coupler shown by tests to be capable of developing in tension 175 percent of the strength of the reinforcing bar without damage to the concrete.
  2. Steel Plate: Meet ASTM A 36.

## **PART 3      EXECUTION**

### **3.1      PLACEMENT**

- A.      Maintain a clean surface keeping all reinforcement free from loose mill scale, loose or thick rust, dirt, paint, oil, or grease.
- B.      Bend all bars accurately.
- C.      Place all reinforcement in designated position and securely hold in position while placing and compacting concrete.
- D.      Wire bars together with ties at all intersections except when spacing is less than 9 inches in each direction, in which case, tie at alternate intersections.
- E.      Maintain the specified distance from the forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers, or other approved devices.
- F.      Precast concrete block bar supports are only allowed when the concrete is placed in contact with the soil and then only as the support for the bottom mat of bars.
- G.      Do not tack weld reinforcing bars in place.
- H.      Overlap at least one panel of welded-wire fabric sheets to each other and fasten at the ends and edges.
- I.      Support reinforcing steel for concrete “T” beams, pier caps, approach slabs, and deck slabs on metal chairs or slab bolsters following this Section, article 2.4.
- J.      Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 4 ft on center of the bar in each direction.
- K.      Tie deck steel to beams or forms at regular intervals of not more than 5 ft on center along the beams to prevent steel movement during concrete placement.
- L.      Support reinforcing steel for slabs on grade on metal chairs attached to a sand plate, or use precast concrete block supports following this Section, article 2.4.
- M.      Engineer verifies placing and fastening of reinforcement in each section of work before any concrete is deposited.

### **3.2 FIELD CUTTING**

- A. Saw or shear coated bars that are specified to be cut in the field. Do not flame cut.
- B. Repair the sawed or sheared end using the specified patching or repair material.

### **3.3 SPLICING**

- A. Furnish all reinforcing steel in the lengths specified.
- B. Do not splice bars, except where specified.
- C. Stagger splices as far as possible.
- D. Place and tie lapped splices in the bars. Maintain the minimum distance to the surface of the concrete shown.
- E. Do not lap splice No. 14 and No. 18 bars.
  - 1. Use mechanical butt splices when using No. 14 or No. 18 bars.
    - a. Decide the number and location of the splices with the following limitations:
      - 1) Extend bars a minimum of 10 ft above the top of footing.
      - 2) Stagger splices such that no particular bar designation is spliced more than 50 percent in 5 ft.
    - b. Use a standard, approved, exothermic process for mechanical butt splicing where the molten filler metal, contained by a high-strength steel sleeve of larger inside diameter than the bars, is introduced into the annular space between bars and the sleeve and between the ends of the bars.
    - c. After cooling and hardening of the filler metal, the splice must be capable of transferring the minimum ultimate tensile strength of the reinforcing bar from one bar to the other by the mechanical strength of the splice components.
    - d. The splice must not depend on fusion of the filler metal with the bars.
      - 1) Do not heat the bars to their melting point during the splicing process.
      - 2) Do not allow the degree of heat required to affect the splice to decrease the structural properties of the bars or affect their original hardness.

- e. Splice according to the manufacturer's recommendations using the manufacturer's standard jigs, clamps, ignition devices, and other required accessories to make splices. Preheat bars where required by the manufacturer.
- F. Use one of the following mechanical butt splices for bars sizes No. 3 through No. 11 when designated on the plans. Follow the manufacturer's published recommendations for equipment and splicing procedures.
  - 1. A full mechanical connection that develops in tension or compression at least 175 percent of the specified yield strength of the bar.
  - 2. As described in this Section, article 3.3, paragraph E.

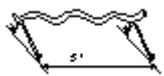
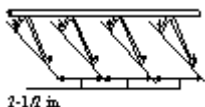



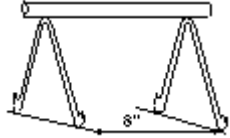
### **3.4 BENDING**

- A. Bend reinforcement to the shapes specified. Refer to CRSI Manual of Standard Practice.
- B. Do not heat the bars during the bending operations.
- C. Cut and bend as specified.
- D. Complete all bending before coating except as specified for bent bars.

### **3.5 FIELD QUALITY CONTROL**

- A. Have the coated bars inspected for damage to the coating after the bars are in place and immediately before concrete placement.
- B. Repair all visible defects using the specified method recommended by the coating manufacturer.

## Bar Supports

Types and Sizes				Minimum Wire Sizes <sup>2</sup> and Geometry			
Symbol	Bar Support Illustration	Type of Support	Standard Sizes	Nominal Height	Carbon Steel		Geometry
					Top	Legs	
SB <sup>1</sup>		Slab Bolster	3/4, 1, 1-1/2, and 2 inch heights in 5 ft and 10 ft lengths	All	4 ga. Corrugated	6 ga.	Legs Spaced 5 inches on Center, Vertical Corrugations Spaced 1 inch on Center (See Note 3)
BB <sup>1</sup>		Beam Bolster	1, 1-1/2, and 2 inch; over 2 inch to 5 inch heights in increments of 1/4 inch lengths of 5 ft.	Up to 1-1/2 inch incl.	7 ga.	7 ga.	Legs Spaced 2-1/2 inches on Center (See Note 3)
				Over 1-1/2 inch to 2 inches incl.	7 ga.	7 ga.	
				Over 2 inches to 3-1/2 inches incl.	4 ga.	4 ga.	
				Over 3-1/2 inch	4 ga.	4 ga.	
BC		Individual Bar Chair	3/4, 1, 1-1/2, and 1-3/4 inch heights	All	-----	7 ga.	(See Note 3)
JC		Joist Chair	4, 5, and 6 inch widths and 3/4, 1, and 1-1/2 inch heights	All	-----	6 ga.	(See Note 3)
HC or HPC*	 * SAND PLATE NEED NOT BE COATED	Individual High Chair	2 inch to 15 inch heights in increments of 1/4 inch.	2 inches to 3-1/2 inches incl.	-----	4 ga.	Legs at 20 degree or less with vertical. When height exceeds 12 inches, legs are reinforced with welded crosswires or encircling wires (See Note 4)
				Over 3-1/2 inches to 5 inches incl.	-----	4 ga.	
				Over 5 inches to 9 inches incl.	-----	2 ga.	
				Over 9 inches to 15 inches incl.	-----	0 ga.	
CHC		Continuous High Chair	Same as HC in 5 ft and 10 ft lengths	2 inches to 3-1/2 inches incl.	2 ga.	4 ga.	Legs at 20 degree or less with vertical. All legs 8-1/4 inches on center maximum, with leg within 4 inches of end of chair, and spread between legs not less than 50 percent of nominal height. (See Note 5)
				Over 3-1/2 inches to 5 inches incl.	2 ga.	4 ga.	
				Over 5 inches to 9 inches incl.	2 ga.	2 ga.	
				Over 9 inches to 15 inches incl.	2 ga.	0 ga.	

Notes and Bar Supports Table, see next page.

Notes:

1. Top wire on continuous supports, not otherwise designated as corrugated, may be straight or corrugated at the option of the manufacturer.
2. Minimum wire sizes are American steel and wire gauges.
3. To provide adequate stability against overturning, the leg spread measured between points of support on the minor axis of the support must not be less than 70 percent of the nominal height.
4. To provide adequate stability against overturning, the leg spread measured between points of support on the minor axis of the support must not be less than 55 percent of the nominal height.
5. To provide adequate stability against overturning and to provide adequate load capacity, the leg spread measured between points of support on the minor axis of the support must not exceed the minimum and maximum percentages of the nominal height, as shown.

Nominal Height (inches)	Distance Between Supports as a Percent of Nominal Height	
	Minimum	Maximum
Under 4	70	No Limit
4	70	95
6	65	90
8	60	85
10	55	80
12	50	75
Over12	50	75

END OF SECTION

**Supplemental Specification  
2005 Standard Specification Book**

**SECTION 03310**

**STRUCTURAL CONCRETE**

**Delete Section 03310 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Materials and procedures for constructing structural concrete, including box culverts, concrete slope protection, diversion boxes, catch basins, cleanout boxes and other items as specified.
- B.      High Early Strength Concrete for closure joint at each end of bridge deck and the longitudinal or transverse closure joints between all the precast concrete deck panels, bridge parapets and approach slabs as shown on plans.

**1.2      RELATED SECTIONS**

- A.      Section 00555: Prosecution and Progress
- B.      Section 02317: Structural Excavation
- C.      Section 02752: Portland Cement Concrete Pavement
- D.      Section 03055: Portland Cement Concrete
- E.      Section 03152: Concrete Joint Control
- F.      Section 03211: Reinforcing Steel and Welded Wire
- G.      Section 03390: Concrete Curing
- H.      Section 05822: Bearings
- I.      Section 05832: Expansion Joints

### **1.3 REFERENCES**

- A. AASHTO M 85: Standard Specification for Portland Cement (Chemical and Physical)
- B. AASHTO M 111: Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
- C. AASHTO M 148: Liquid Membrane-Forming Compounds for Curing Concrete
- D. AASHTO M 153: Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
- E. AASHTO M 213: Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- F. AASHTO M 235: Epoxy Resin Adhesives
- G. AASHTO LRFD Bridge Construction Specifications Section 3 (Temporary Works)
- H. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation
- I. American Concrete Institute (ACI) Standards

### **1.4 SUBMITTALS**

- A. Falsework Drawing:
  - 1. When required in the contract or requested by the Engineer, submit for approval three copies of falsework drawings and design calculations (prepared and sealed by a licensed professional engineer in the State of Utah) at least two weeks before construction starts or electronically at least one week before construction starts.
  - 2. Comply with AASHTO LRFD Bridge Construction Specifications Section 3 (Temporary Works).
- B. When specified in the plans, design and submit to the Engineer for approval a High Early Strength Concrete mix design, which attains a 24 hour compressive strength of 3000 psi and a 28-day compressive strength ( $f'_{c}$ ) of 4000 psi minimum. Provide a certificate stating that the mix submitted meets the requirements for coarse aggregate, fine aggregate, cement, water, admixtures and curing materials in Section 03055 at least two weeks before its use.
- C. Cold Weather Plan according to this Section, article 3.8.

- D. Surface Evaporation Plan according to this Section, article 3.8.

## **1.5 ACCEPTANCE- Price Adjustments for Strength**

- A. Use a pay factor of 1.0 when concrete strength meets or exceeds the specified strength.
- B. When concrete is below specified strength:
1. Department may accept item at a reduced price.
  2. The pay factor applies to the portion of the item that is represented by the strength tests that fall below specified strength.
  3. Department calculates the pay factor as follows:

<b>Percent below specified strength:</b>	<b>Pay Factor:</b>
0-2 percent	0.9
2-4 percent	0.8
4-6 percent	0.7
6-8 percent	0.6
8-10 percent	0.5
  4. Remove and replace all concrete represented by the test if the concrete strength is less than 90 percent of the specified strength.

## **PART 2 PRODUCTS**

### **2.1 CONCRETE**

- A. Class AA(AE) concrete, unless specified otherwise.
1. Meet a 28-day flexural strength of 650 psi verified through trial batch.
- B. Concrete Slope Protection: Class A(AE).
- C. Refer to Section 03055.
- D. For High Early Strength Concrete use air-entrained concrete composed of Portland Cement, fine and coarse aggregate, admixtures, and water.
1. Use either air-entraining Portland cement or an approved air-entraining admixture to obtain the air-entraining feature.
    - a. The entrained air content to be no less than 4 percent or more than 7 percent.
  2. Conform to the requirements of AASHTO M 85 for cement.

## **2.2 REINFORCING STEEL AND WELDED WIRE**

- A. Refer to Section 03211.

## **2.3 JOINTS AND SEALERS**

- A. Pre-Molded Joint Filler meeting AASHTO M 153.
  - 1. Concrete Slope Protection: Refer to Section 03152.
- B. Preformed Joint Filler: AASHTO M 213.

## **2.4 BACKER ROD**

- A. Use backer rod composed of closed-cell polyethylene foam of sufficient size to prevent the sealant from passing to the bottom of the groove.
- B. Refer to Section 03152.

## **2.5 WATERSTOPS**

- A. Refer to Section 03152.

## **2.6 RIGID PLASTIC FOAM**

- A. Preformed, extruded, cellular polystyrene thermal insulation material that has a water absorption property of 0.3 or less.
- B. Refer to ASTM C 578.

## **2.7 CURING COMPOUND**

- A. As specified. AASHTO M 148, Type I-D, Class A.

## **2.8 FORMS**

- A. Plywood, wood, metal, glass, or a combination of these materials.

## **2.9 MISCELLANEOUS STEEL ITEMS**

- A. Galvanize all miscellaneous steel items permanently cast into structural concrete elements (AASHTO M 111).

## **PART 3      EXECUTION**

### **3.1      PREPARATION**

- A.    Falsework
  - 1.    Construction:
    - a.    Use materials able to sustain the stresses required by the falsework design.
    - b.    Use suitable jacks or wedges to set the forms to the grade or camber required, and to prevent settling.
    - c.    Produce a finished structure of the specified camber, and built to the lines and grades indicated.
  - 2.    Footing Construction:
    - a.    Build falsework on a solid footing that is safe against undermining, protected from softening, and capable of supporting any imposed loads.
    - b.    Demonstrate that the soil bearing values do not exceed the supporting capacity of the soil. (Conduct load tests or have soils investigation conducted by a licensed professional engineer.)
    - c.    Use piling or caissons to support falsework that cannot be founded on a solid footing.
    - d.    Space, drive, and remove piles following approved falsework drawings.
  - 3.    Design and construct all falsework according to AASHTO LRFD Bridge Construction Specifications Section 3 (Temporary Works).
- B.    Forms
  - 1.    Use mortar-tight concrete forms, true to the dimensions, lines, and grades of the structure, and of sufficient strength to prevent deflection during the placement of concrete.
  - 2.    Discontinue using any form or forming system that produces a concrete surface with excessive undulations until modifications have been made. Undulations are excessive if they exceed either  $\frac{1}{8}$  inches or  $\frac{1}{270}$  of the center-to-center distance between studs, joints, forms, fasteners, or wales.
  - 3.    Countersink all bolt and rivet holes when using metal forms for exposed surfaces so that a plane, smooth surface of the desired contour is obtained.
  - 4.    Use lumber that is free of knotholes, loose knots, cracks, splits, warps, or other defects that affect the strength or appearance of the structure. Rough lumber may be used for forming surfaces if visible rough surfaces do not show on the final structure.
  - 5.    Form all exposed surfaces of each element of a concrete structure with the same forming material or with such materials that produce a concrete surface that is uniform in texture, color, and appearance.

6. Clean the inside surface of forms of all dirt, mortar, and foreign material before concrete placement.
  7. Use form oil that permits the ready release of the forms and does not discolor the concrete.
  8. Do not place concrete in the forms until:
    - a. All work connected with form construction has been completed.
    - b. All embedded materials have been placed.
    - c. All dirt, chips, sawdust, water, and other foreign materials have been removed.
    - d. Inspection and approval have been obtained.
  9. Do not use stay-in-place deck forms unless otherwise specified.
- C. Footings
1. Excavation: Refer to Section 02317.
  2. The Engineer may direct written changes in dimensions or elevations necessary to secure a satisfactory foundation.
  3. Do not dewater by pumping during concrete placement, or for 24 hours thereafter, unless pumping is outside the enclosure. Do not use well points to dewater footing.

### **3.2 GIRDERS, SLABS, AND COLUMNS**

- A. Deck: Cure deck concrete at least seven days and until it has attained required design strength before placing parapet forms or leave all falsework in place and design it to carry all additional loads that are part of the parapet placement process.
- B. Slab Span: Place concrete in one continuous operation.
- C. Cast-In-Place T-Beams:
1. Place concrete in one or two continuous operations: The first to the top of the girder stems and the second to completion.
  2. Obtain a bond between the stem and slab that is positive and mechanical, and secured by means of shear keys in the top of the girder stem.
- D. Concrete in columns:
1. When column is being placed on a footing, allow footing concrete to set until it has attained 75 percent of its design strength based on field cylinder breaks before placing column forms.
  2. Place concrete in one continuous operation.
  3. Allow concrete to set at least two days before placing caps.
  4. Do not place concrete in the superstructure until the columns have been stripped and approved.

- E. Substructure Concrete: Do not place the superstructure load on the bents or abutments until they have been in place at least seven days or attained 75 percent of the design strength based on field cylinder breaks.

### **3.3 BOX CULVERTS**

- A. Allow base slab and footing to cure until they have both attained 75 percent of their design strengths based on field cylinder breaks before the remainder of the culvert is constructed.
- B. Construct side walls and top slab monolithically unless the wall height exceeds 10 ft. Keep the construction joints vertical and at right angles to the axis of the culvert.
- C. When side walls and top slab are not placed monolithically, construct shear keys in the top of the side walls for anchoring the top slab.
- D. Construct wingwalls monolithically.
- E. Do not backfill until all concrete has attained 100 percent of its required design strength based on field cylinder breaks.

### **3.4 CONCRETE SLOPE PROTECTION**

- A. Preparing subgrade:
  - 1. Prepare the area to be paved by smoothing and shaping the berms and slopes and excavating for the cut-off walls.
  - 2. Fill and compact all depressions and humps.
  - 3. Furnish extra material to properly finish the slopes when required.
  - 4. Compact all soft and yielding material resulting in a firm and substantial subgrade of uniform density.
  - 5. Thoroughly sprinkle the area with water before placing the concrete.
  - 6. Have the Engineer approve all surfaces before placing concrete.
- B. Placing concrete:
  - 1. Do not place concrete upon spongy, frozen, or unstable surfaces.
  - 2. Provide concrete of a consistency that it can be placed on the slopes without deformation.
  - 3. Complete all scoring as indicated on the plans.
  - 4. Complete the entire slope protection in one placement if possible, or terminate the placement with a construction joint located in a scoring or at the junction of the slope and the abutment.
  - 5. Finish concrete using a Floated Surface Finish according to this Section, article 3.11. Cure according to Section 03390.

- C. Sealing joints and closures:
1. Furnish 1-inch thick, rigid plastic foam (styrofoam) for all expansion joints located between structural members and the slope protection.
  2. Place the rigid plastic foam material against the surface of all structural members before placing the concrete slope protection.
  3. Anchor the rigid plastic foam in place with a compatible adhesive or other approved methods.
  4. Seal this area just before final inspection.
  5. Remove curing compounds, oil, grease, dirt, and any other foreign materials from concrete surfaces and grooves by sandblasting or other permitted methods.
  6. Place the backer rod and sealant after the concrete has properly cured.
  7. Apply the backer rod and sealant to clean and dry concrete surfaces.
  8. Place sealant with hand or power-operated caulking guns after placing the backing materials. Refer to Section 03152.
    - a. Limit the depth of sealant in the groove to  $\frac{3}{8}$  inch.
    - b. Start the placement at one side and proceed to the other side on horizontal grooves and from top to bottom on vertical grooves.
    - c. Use a concave pointing tool with soap solution to tool the sealant.
  9. Do not place the sealant unless temperatures are at least 50 degrees F and rising.
- D. Replacement
1. Prepare subgrade, place concrete and seal joints and closures per this Section, paragraphs A, B and C.
  2. Place concrete slope protection within seven days after removing damaged concrete slope protection. Refer to Section 03055.
  3. Connect reinforcement to existing concrete slope protection to remain in place as shown in the plans.
  4. Use a sealant that meets the requirements in Section 03152.

### **3.5 PLACING CONCRETE**

- A. Do not place concrete without approval.
- B. Remove struts, stays, and braces that hold the forms in correct shape and alignment when no longer necessary.
- C. Mix and transport concrete according to the limitations specified in Section 03055.
- D. Do not deviate from the placement schedule without written approval.

- E. If the concrete cannot be protected during adverse weather, the Engineer may postpone placement operations.
- F. Observe the following precautions when handling concrete:
1. Avoid segregation of the ingredients.
  2. Arrange chutes, troughs, or pipes used as aids in placing concrete so the concrete does not separate.
  3. Use metal or metal-lined chutes and troughs. (Do not use aluminum.)
  4. Equip chutes with baffle boards or a reversed section at the end of the outlet when placing on steep slopes.
  5. Extend open troughs and chutes down inside the forms or through holes left in the forms; terminate the ends in vertical downspouts.
  6. Thoroughly flush all chutes, troughs, and pipes with water before and after each placement.
  7. Do not allow the free-fall of concrete to exceed 10 ft for thin walls (maximum 10 inch thickness) or 5 ft for other types of construction without the use of a tremie or a flexible metal spout.
  8. Use flexible metal spout sections composed of conical sections not more than 3 ft long, with the diameter of the outlet and the taper of the various sections such that the concrete does fill the outlet and retards concrete flow.
- G. Observe the following precautions when placing concrete:
1. Deposit concrete as close as possible to its final position, without allowing it to flow laterally in the form.
  2. Spread fresh concrete in horizontal layers with thickness not greater than what can be compacted with vibrators.
  3. Do not use vibrators to flow concrete laterally.
  4. Limit placement interruptions to 45 minutes.
  5. Place and compact each layer before the preceding layer has taken initial set.
  6. Do not place concrete in water flowing under head within the area of a footing.
  7. Pass the screed over the area with a screed face device to measure the cover before concrete placement.
  8. Relocate and tie reinforcing steel that projects above the specified level before placing the concrete.
  9. Raise and support reinforcing steel that is more than ¼ inch below the specified level before placing the concrete.
  10. Firmly support screed rails for bridge deck slabs to prevent movement during concrete placement. When using a finishing machine, support the machine rails on the bridge beams. (Do not place the machine rails on the forms unless the form supports have been strengthened and the Engineer gives written approval.)

- H. Observe the following precautions when compacting concrete:
  - 1. Use high frequency internal vibrators to compact all concrete for structures (except concrete placed under water).
  - 2. Supply enough vibrators to compact the fresh concrete to the desired degree within 15 minutes after it is deposited in the forms.
  - 3. Supply at least two vibrators for structures involving more than 25 yd<sup>3</sup> of concrete.
  - 4. Do not attach vibrators to or against the forms or the reinforcing steel.
  - 5. Do not allow vibrators to penetrate layers of concrete that have taken initial set.
  - 6. Use spades or wedge-shaped tampers to secure a smooth and even texture of the exposed surface.
- I. When using High Early Strength Concrete, verify that design strength has been obtained by field cylinder breaks.

### **3.6 PLACING CONCRETE UNDER WATER**

- A. Place and deposit concrete under water when specified on the plans.
- B. Seal the forms or cofferdams watertight.
- C. Do not pump water while placing concrete or disturb the concrete until it has set at least 24 hours, or attained at least 50 percent of its design strength.
- D. Regulate placing to keep surfaces approximately horizontal at all times.
- E. Place the concrete by beginning at one end of the form and progressing in a zig-zag movement from side to side across the length of the form.
- F. Place the concrete using a tremie or concrete pumping equipment.
- G. Observe the following steps when placing concrete with a tremie:
  - 1. Use an 8-inch to 12-inch diameter steel tube tremie constructed with watertight connections, a hopper to receive concrete, and a device at the bottom to exclude water from entering the tube.
  - 2. Use support that permits the discharge end to move over the entire top work surface and permits the tremie to be rapidly lowered to stop or retard flow when necessary.
  - 3. Minimize the number of tremie location shifts for continuous placement.
  - 4. Keep the tremie tube full to the bottom of the hopper during placement.
  - 5. Slightly raise the tremie when a batch is dumped into the hopper, but do not raise it out of the concrete at the bottom until the batch discharges to the bottom of the hopper. If the concrete seal around the tube is lost, re-plug the end and refill the tube with concrete.

### **3.7 PUMPING CONCRETE**

- A. Place concrete with a concrete pump in good operating condition. Replace pump that causes excessive or erratic loss of air entrainment.
  - 1. Use a pump that produces a continuous stream of concrete without air pockets.
  - 2. Do not add water to the concrete in the pump hopper.
- B. Do not allow pump vibrations to damage freshly placed concrete.
- C. Do not use concrete contaminated by the priming or cleaning of the pump.

### **3.8 LIMITATIONS**

- A. If either mixing, placing, or finishing occurs after daylight hours, light the work site so all operations are plainly visible. Refer to Section 00555.
- B. Keep all traffic off concrete bridges and culverts for 14 days after final concrete placement.
- C. Cold Weather:
  - 1. Cold weather limitations apply when the temperature is likely to fall below 40 degrees F within 14 days of placement.
  - 2. Comply with the following regulations for placing concrete in cold weather:
    - a. Submit a written plan for approval 14 calendar days before concrete placement.
    - b. Do not use chemical additives in the concrete to prevent freezing.
    - c. Provide all necessary cold weather protection for in-place concrete (cover, insulation, heat, etc.).
    - d. Do not place concrete in contact with frozen surfaces.
    - e. Produce concrete with a temperature between 60 degrees F and 90 degrees F at the time of placing.
    - f. Adequately vent combustion-type heaters that produce carbon monoxide.
    - g. Maintain the concrete temperature above 50 degrees F and below 120 degrees F with no more than a 40 degree F temperature gradient at any one time for the first 14 days after placing.
    - h. Protect the concrete from freezing until a compressive strength of at least 3,500 psi has been achieved.
    - i. Maintain moist conditions for exposed concrete not in contact with forms; avoid loss of moisture from the concrete due to heat applied.

- j. Limit the drop in temperature next to the concrete surfaces when removing heat to 20 degrees F during any 12-hour period until the surface temperature of the concrete reaches that of the atmosphere.
  - k. Determine the concrete temperature with a surface thermometer insulated from surrounding air.
  - l. Remove and replace concrete damaged by frost action at no additional cost to the Department.
- 3. Heating Aggregate and Water:
  - a. Provide and operate heating devices at no additional cost to the Department when heated aggregates are required.
  - b. Aggregates must be free of ice.
  - c. Heat aggregates uniformly, when required. Avoid overheating or developing hot spots.
  - d. Use either steam or dry heat.
  - e. To avoid the possibility of a quick or flash set of the concrete when either the water or aggregates are heated to above 100 degrees F, they should be combined in the mixer first before the cement is added.
    - 1) If this mixer-loading sequence is followed, water temperatures up to the boiling point can be used provided the aggregates are cold enough to reduce the final temperature of the aggregates and water mixture to less than 100 degrees F.
- D. Hot Weather: Cool all form surfaces that will come in contact with the concrete to below 95 degrees F.
- E. Hot Weather (Only Decks and Approach Slabs)
  - 1. Begin placing concrete when the temperature is declining.
  - 2. Begin batching operations when the air temperature in the shade is 85 degrees F or less.
  - 3. Discontinue placing when the temperature reaches 80 degrees F in the shade and is increasing.
- F. Surface Evaporation:
  - 1. Surface evaporation limitations apply and may occur at any time of the year, when any combination of air temperature, relative humidity, and wind velocity, that have the potential to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. Submit a written plan for approval 14 calendar days before concrete placement that shows proper attention will be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures and water evaporation that could impair strength or serviceability of the concrete. Refer to ACI 305.

2. The surface evaporation plan may include any of the following actions:
  - a. Construct windbreaks or enclosures to effectively reduce the wind velocity throughout the area of placement.
  - b. Use fog sprayers upwind of the placement operations to effectively increase the relative humidity.
  - c. Reduce the temperature of the concrete by shading the material storage area or production equipment, cool aggregate by sprinkling, cool aggregate or water by refrigeration or by replacing a portion or all of the mix water with flaked or crushed ice to the extent that the ice will completely melt during mixing of the concrete.
  - d. Adjustment of the placement schedule.
  - e. Use an approved water-based mono-molecular polymer liquid evaporative reducer at application rates recommended by the manufacturer. Do not use as a finishing aid.

### **3.9 EXPANSION JOINTS AND BEARINGS**

- A. For expansion joints, refer to Section 05832.
- B. For bearings, refer to Section 05822.
- C. Adjust bearing positions and joint widths as shown on plans.

### **3.10 CONSTRUCTION JOINTS**

- A. Make construction joints where shown on plans or in the placing schedule.
- B. Obtain Engineer's written approval when additional construction joints are desired and meet the following requirements:
  1. Place and construct without impairing strength and appearance.
  2. Place in planes perpendicular to the principal lines of stress and at points of minimum shear.
  3. Make monolithic structures by extending the reinforcing across the joint.
  4. Avoid construction joints through paneled wing walls or large surfaces which are to be treated architecturally.
  5. Make a straight line joint across the face of the pour for the full width of the bridge deck.
  6. Leave a rough surface to increase the bond with the concrete placed later.
  7. Form tapered sections with an insert so that the succeeding layer of concrete ends in a section at least 6 inches thick.
  8. Place a bulkhead from the surface to the top mat of steel to ensure a straight vertical face. Shape the concrete below the top steel to a near vertical face in line with the bulkhead.

9. When a bulkhead cannot be placed, establish a straight vertical face by saw cutting to a minimum depth of 1 inch. Shape the concrete below the saw cut to a near vertical face.
- C. Before resuming concrete placement, meet the following:
1. Re-tighten forms.
  2. Roughen the surface of hardened concrete without leaving loosened particles or damaged concrete.
  3. Clean off concrete surface of foreign matter and laitance by sandblasting.
  4. Saturate concrete surface with water.
  5. Apply epoxy adhesive as specified to face of construction joints.

### **3.11 CONCRETE SURFACE FINISHING CLASSIFICATIONS**

- A. Ordinary Surface Finish: A true and uniform finished surface.
- B. Rubbed Finish: A surface smooth in texture and uniform in appearance, free of all form marks or irregularities.
- C. Wire Brush or Scrubbed Finish:
1. A finished surface with the cement surface film completely removed and the aggregate particles exposed leaving an even-pebbled texture.
  2. An appearance ranging from fine granite to coarse conglomerate depends on the size and grading of the aggregate used.
- D. Floated Surface Finish:
1. For flat work: strike off and use a floated surface finish.
  2. For bridge decks and approach slabs: machine finish only.

### **3.12 CONCRETE SURFACE FINISHING**

- A. Give all formed concrete surfaces at least an Ordinary Surface Finish except as specified otherwise.
- B. Use other types of finishes as required in addition to the Ordinary Surface Finish.
- C. Provide a Rubbed Finish for all surfaces that cannot meet Ordinary Surface Finish requirements due to irregularities, honeycombing, excessive surface voids, discoloration, and other defects.

### 3.13 CONCRETE SURFACE FINISHING PROCEDURES

#### A. Ordinary Surface Finish:

1. After removing forms, remove all fins and projections.
  - a. Clean, point, and true all honeycomb spots, broken corners or edges, cavities made by form ties, and other holes and defects.
  - b. Keep all areas to receive mortar saturated with water for at least 30 minutes before mortar placement.
2. For pointing, use a mortar of cement and fine aggregate, not more than one hour old, mixed in the proportions used in the grade of concrete being finished.
3. Cure the mortar patches and rub to blend with surrounding concrete.
4. Tool and free all joints of mortar and concrete. Leave the full length of the joint filler exposed with clean and true edges.

#### B. Rubbed Finish:

1. Wet the surface of concrete while still green, paint with grout, and rub with a wooden float until the surface is covered with a lather of cement and water.
  - a. A thin grout (one part cement, one part fine sand) may be used in the rubbing.
  - b. Let this lather set for at least five days, then rub lightly with a fine carborundum stone until smooth.
2. For hardened concrete, use a mechanically operated carborundum stone to finish the surface at least four days after placing.
  - a. Finish in the same manner as above; however, let the lather set for at least 15 days before lightly rubbing with a fine carborundum stone until smooth.
3. Commercial grade rubbing mortar may be used if approved by Engineer.

#### C. Wire Brush or Scrubbed Finish:

1. After the forms are removed and the concrete is green, scrub the surface with stiff wire or fiber brushes using a solution of muriatic acid (one part acid, four parts water).
2. Once the scrubbing produces the desired texture, wash the entire surface.
3. Use water mixed with 5 percent by volume ammonium hydroxide to remove all traces of the acid.

#### D. Floated Surface Finish on flat work other than bridge decks and approach slabs:

1. Striking Off:
  - a. After compaction, carefully rod and strike off the surface with a strike board following the cross sections and grades shown on the plans.
  - b. Allow for camber as required.

- c. Operate the strike board longitudinally or transversely and move it forward with a combined longitudinal and transverse motion, ensuring that neither end is raised from the side forms during the process.
    - d. Keep a slight excess of concrete in front of the cutting edge at all times.
  - 2. Floating:
    - a. Use longitudinal, or transverse floating, or both to create a uniform surface.
    - b. Longitudinal floating is required except in places where it is not feasible.
  - 3. Longitudinal Floating:
    - a. Work the longitudinal float, operated from foot bridges, with a sawing motion while holding it parallel to the road centerline.
    - b. Pass gradually from one side of the pavement to the other. Move the float forward one-half of its length and repeat operation.
    - c. Substitute machine floating, if equivalent results are produced.
  - 4. Transverse Floating:
    - a. Operate the transverse float across the concrete surface by starting at the edge and slowly moving to the center and back again to the edge.
    - b. Move the float forward one-half of its length and repeat the operation.
    - c. Preserve the crown and cross section of the concrete surface.
  - 5. Straightedging:
    - a. Test the concrete surface for trueness with a straightedge after the longitudinal floating has been completed and the excess water has been removed, but while the concrete is still plastic.
    - b. Furnish and use an accurate 10 ft straightedge held parallel to the road centerline in contact with the surface.
    - c. Check the entire area, immediately filling depressions with freshly mixed concrete, then strike off, consolidate, and refinish.
    - d. Cut down and refinish high areas.
    - e. Continue the straightedge testing and re-floating until the concrete surface is at the required grade and contour.
- E. Floated Surface Finish for bridge decks and approach slabs:
- 1. Machine-finish exposed surfaces unless otherwise permitted.
  - 2. Finish concrete by striking off and floating the surface.
  - 3. Allow the Engineer enough time to inspect finishing machines during daylight hours before concrete placement.
  - 4. Stop finishing operations hampered by darkness unless lighting facilities are provided.

5. Extend finishing machine rails beyond both ends of the scheduled placement, and allow sufficient distance to permit the float to fully clear the concrete.
6. Use adjustable rails set to elevations established by the Engineer, installed to prevent springing or deflection under the weight of the finishing equipment, and placed to operate without interruption.
7. Place screed machine parallel to the abutments and bents within 10 degrees.
8. Support screed rails to prevent movement during placing of the concrete.
9. Either support finishing machine rails on the bridge beams or on form supports stiffened to prevent deflection.
  - a. Obtain written approval before using form supports.
  - b. This may require load tests.
10. Attach a measuring device to the screed face and pass it over the area.
11. Before placing concrete, relocate and tie reinforcing steel that projects above the specified level, and raise and support steel that is more than  $\frac{1}{4}$  inch below the specified level.
12. Place concrete in a uniform heading approximately parallel to the screed machine.
13. Limit the rate of placing to allow enough time to finish the surface before initial set.
14. Continuously place concrete the full length of the structure or superstructure unit unless otherwise shown or approved.
15. Provide sufficient material, equipment, and manpower to place deck concrete at a minimum rate of  $25 \text{ yd}^3/\text{hour}$ .
16. Strike off the surface to the required elevations with the finishing machine immediately after placing and consolidating the concrete.
17. Do not add water to the concrete in front of or behind the screed.
18. Have the strike-off method and equipment approved. Maintain satisfactory performance. Use equipment capable of finishing concrete within the surface tolerances specified. Maintain satisfactory consolidation and surface tolerance to prevent shutdown and rejection of the equipment.
19. Furnish a 10 ft straightedge to check the surface tolerance, placed both longitudinally and transversely, immediately behind the screed machine and hand-finished areas.
20. Correct irregularities greater than  $\frac{1}{8}$  inch from the straightedge, before additional placement, and immediately fill depressions with concrete, and refinish.
21. Cut down and refinish high areas.
22. Continue straightedge testing and corrective measures until the entire surface is free of observable departures from the straightedge.

- F. Final texturing for bridge decks and approach slabs: (a textured hardened finish):
  - 1. After floating, do not texture finish concrete deck surfaces that are to be covered by a water-proofing membrane system.
  - 2. Use a texture process that produces regular  $\frac{1}{8}$  inch wide transverse grooves spaced randomly from  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch on centers and  $\frac{1}{8}$  inch deep.
  - 3. Keep the finished surface free from porous spots and surface irregularities.
  - 4. Furnish a work bridge that follows the finishing machine to facilitate texturing and application of the membrane-curing compound.
  - 5. Check the surface smoothness for acceptance after the concrete has hardened.
  - 6. If the surface deviates more than  $\frac{1}{8}$  inch from a 10 ft straightedge, remove irregularities by grinding following Section 02752.

### **3.14 CURING**

- A. Refer to Section 03390.

### **3.15 FORM REMOVAL**

- A. Obtain approval before removing forms.
- B. Remove all forms from the concrete surfaces.
- C. Do not use any method of form removal likely to cause overstressing of the concrete.
- D. Remove supports to permit the concrete to uniformly and gradually take the stresses due to its own weight.
- E. Do not remove forms used in ornamental work, railings, parapets, and exposed vertical surfaces for at least six hours after placement.
- F. To determine the condition of columns, always remove forms before removing shoring from beneath beams and girders.
- G. Removing falsework:
  - 1. Do not remove deck falsework until the backfill at the abutments has been placed up to the bottom of the approach slab.
  - 2. Do not remove falsework supporting the deck of rigid frame structures until the fill has been placed in back of the vertical legs.
  - 3. Keep falsework and forms in place under slabs, beams, and girders for 14 days after the day of last concrete placement. Forms for slabs having clear space of less than 10 ft may be removed after seven days.

4. In cold weather, keep forms and falsework in place as approved in the written plan for cold weather concrete.
- H. Patch formed surfaces within 24 hours after form removal:
1. Cut back and remove all projecting wire or metal devices used for holding the forms in place and that pass through the body of the concrete at least 1 inch beneath the surface of the concrete.
  2. Remove lips of mortar and all irregularities caused by form joints.
  3. Fill all small holes, depressions, and voids with cement mortar mixed in the same proportions as that used in the body of the work.
  4. To patch larger holes or honeycombs, obtain a solid uniform surface by chipping away coarse or broken material.
    - a. Cut away feathered edges to form faces perpendicular to the surface.
    - b. Cover with epoxy-adhesive coating as specified. AASHTO M 235, Type II
    - c. Fill the cavity with stiff mortar composed of one part Portland Cement to two parts sand thoroughly tamped into place.
    - d. Pre-shrink the mortar by mixing it approximately 20 minutes. Vary the time according to manufacturer's recommendations, temperature, humidity, and other local conditions.
    - e. Float the surface of this mortar with a wooden float before initial set.
    - f. Keep the patch wet for five days.
    - g. After curing, rub patches on exposed surfaces to blend them with surrounding concrete.
    - h. Add coarse aggregate to the patching material when patching large or deep areas.
    - i. Make a dense, well-bonded, and properly cured patch.
- I. Areas with extensive honeycombing will be rejected. After receiving written notice of rejection, remove and rebuild the structure in part or wholly, as specified, at no additional cost to the Department.
- J. If the Contractor elects to place inserts along the bottom edges of the precast concrete deck panels to form the closure pour joints, apply the following requirements after fully removing all the closure joint forms:
1. Cut off cast-in-place anchors at least 1 inch below the face of slab and repair per this Section, article 2.2.
  2. Fill all voids with dry-pack mortar flush with the bottom of slab.
  3. Fill voids created by the removal of re-usable concrete anchors with dry-pack mortar flush with the bottom of slab.
  4. Dry-pack mortar will be composed of one part Portland cement to two parts sand.

### **3.16 MISCELLANEOUS CONSTRUCTION**

- A. Drainage and weep holes:
  - 1. Construct drainage and weep holes at locations indicated on the plans or as directed.
  - 2. Place ports or vents for equalizing hydrostatic pressure below low water.
  - 3. Use non-corrosive materials for weep hole forms.
  - 4. Remove wooden forms after the concrete is placed.
  - 5. Paint exposed surfaces of metal drains as indicated on the plans.
- B. Anchor Bolts: Securely and accurately set all necessary anchor bolts in piers, abutments, or pedestals as the concrete is being placed.
- C. Bearing plate areas:
  - 1. Finish bridge seat bearing areas high and rub or grind to grade level within an allowable tolerance of  $\pm 1/16$  inch within a tolerance of  $\pm 1/8$  inch of the elevation shown on the plans.
  - 2. Do not grout under bearing plates.

### **3.17 CLEANING**

- A. Clean up by removing all falsework and falsework piling, (down to 2 ft below the finished ground line) rubbish, and temporary building materials before final inspection.

END OF SECTION

**Supplemental Specification  
2005 Standard Specification Book  
SECTION 03339**

**PRECAST CONCRETE DECK PANEL**

**Add Section 03339**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      This work consists of furnishing, erecting, and grouting all precast concrete deck and approach slab panels including all necessary materials and equipment to complete the work as shown on the plans.
- B.      Placing structural non-shrink grout into the girder camber strips and filling the shear stud blockouts in the bridge precast concrete deck panels. This is not for post-tensioning operation.
- C.      Procedures for preparing and installing structural non-shrink grout.

**1.2      RELATED SECTIONS**

- A.      Section 03055: Portland Cement Concrete
- B.      Section 03211: Reinforcing Steel and Welded Wire
- C.      Section 03310: Structural Concrete

**1.3      REFERENCES**

- A.      AASHTO T 106: Compressive Strength of Hydraulic Cement Mortar
- B.      AASHTO T 160: Length Change of Hardened Hydraulic Cement Mortar and Concrete
- C.      AASHTO T 161: Standard Method of Test for Resistance of Concrete to Rapid Freezing and Thawing
- D.      AASHTO T 260: Standard Method of Test for Sampling and Testing Chloride Ion in Concrete and Concrete Raw Materials

- E. ASTM C 666: Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
- F. ASTM C 882: Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
- G. ASTM C 1042: Standard Test Method For Bond Strength of Latex Systems Used with Concrete by Slant Shear
- H. ASTM E 274: Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire
- I. UDOT Quality Management Plan

#### **1.4 SUBMITTALS**

- A. Precast Concrete Deck Panel
  - 1. Shop Drawings furnished to the Engineer for approval 14 days before panel construction begins:
    - a. Five sets half-size, 11½ x 17 inch sheets with a 1½ inch blank margin on the left-hand edge.
    - b. Place the project designation data in the lower right-hand corner of each sheet.
    - c. Prepare shop drawings under seal of a Professional Engineer.
  - 2. Department rejects units fabricated before written approval.
- B. Construction Methods
  - 1. Provide construction methods to Engineer for approval 14 days before construction begins.
  - 2. Submit five copies of shop drawings to the Engineer for approval. Drawings designed by a Professional Engineer include but are not limited to the following:
    - a. Type and location of lifting inserts or devices.
    - b. Details of vertical adjusting hardware.
  - 3. Do not order materials or begin work until receiving final approval of the shop detail drawings.
  - 4. All details are subject to modification or approval.
  - 5. Do not deviate from the approved shop drawings unless authorized in writing. Contractor is responsible for costs incurred due to faulty detailing or fabrication.
- C. Erection Plan
  - 1. Follow the sequence shown on the plans to remove the existing bridge deck slab and erect the new deck composed of precast concrete deck panels.

2. Submit a detailed plan to Engineer for approval 14 days before the panel erection begins. This detailed plan will include, but not be limited to the following information:
  - a. Approximate location of cranes.
  - b. Method of forming closure joints.
- D. Structural Non-Shrink Grout
  1. Certificate of Compliance to Engineer.
  2. Submit a proposed method for forming the girder camber strips and installing the structural non-shrink grout, sequence, and equipment for grouting operation to Engineer for approval 14 days before placing structural non-shrink grout begins.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Use Class AA (AE) concrete for precast concrete deck panels as specified in Section 03055 and on the plans. Self-consolidating concrete mix designs may be submitted to Engineer for approval as an alternate to the structural concrete for the precast deck panels.
- B. Use coated reinforcing steel as specified in Section 03211.
- C. Show vertical adjusting hardware devices on the plans. Alternative devices may be substituted with approval from the Engineer.
- D. Use mechanical threaded couplers when specified for precast concrete deck panel reinforcing as specified in Section 03211.
- E. Use structural non-shrink grout for girder camber strips and shear stud blockouts.
  1. Mix structural non-shrink grout just prior to use, in accordance with the manufacturer's instructions.
  2. Use concrete gray in color and containing no calcium chloride or admixture containing calcium chloride or other ingredient in sufficient quantity to cause corrosion to steel reinforcement.
  3. Use quick-setting, rapid strength gain, non-shrink, and high-bond strength grout.
  4. Warranty the in-place structural non-shrink grout performance and workmanship for two years.
  5. Repair or refund at the Department's option any bonding failures that occur during the warranty period.

6. Use structural non-shrink grout that meets a minimum compressive strength of 3,000 psi within 24 hours and 5,000 psi within seven days when tested as specified in AASHTO T 106.
7. Meet all the requirements of AASHTO T 160 with the exception that the Contractor-supplied cube molds will remain intact with a top firmly attached throughout the curing period.
8. Use structural non-shrink grout having no expansion after seven days and a one-hour compressive strength of 500 psi.
9. Refer to Table 1 for structural non-shrink grout requirements.

**Table 1**

<b>Structural Non-Shrink Grout</b>			
<b>*Properties</b>	<b>Requirements</b>	<b>ASTM</b>	<b>AASHTO</b>
Accelerated Weathering	As Specified in ASTM or AASHTO	C 666	T 260
Accepted Bond Strengths	>1,000 psi @ 24 Hours	C 882 or C 1042	
Test Medium	<3% White Utah Road Salt		T 161
Accepted Weight Loss	<15% @ 300 Cycles		T 161
Friction Number	>40	E 274	

\* Certified test results from a private AASHTO accredited testing laboratory will suffice for acceptance.

F. Use a UDOT Certified Concrete Precaster or a pre-qualified project site caster for concrete products in accordance with the Department Quality Management Plan: Precast-Prestressed Concrete Structures.

G. Cure all panels for a minimum of 14 days prior to placing on superstructure.

## **PART 3 EXECUTION**

### **3.1 FABRICATION**

A. Do not place concrete in the forms until the Engineer has inspected and approved the placement of all materials in the deck panels.

B. Finish the precast concrete deck panels following Section 03310.

### **3.2 PLACING PRECAST CONCRETE DECK PANELS**

A. Place the precast concrete deck panels as shown on the plans.

- B. Check the grade of the deck panels after all deck panels in a span are placed and adjusted to provide the elevations shown on the plans.
- C. After the proper grade is achieved, prevent shifting of the precast concrete deck panels during the joining of all the deck panels.

### **3.3 PREPARATION AND INSTALLATION OF STRUCTURAL NON-SHRINK GROUT**

- A. Clean and remove all debris from the girder camber strips and shear stud blockouts prior to placement of the structural non-shrink grout.
- B. Keep bonding surfaces free from laitence, dirt, dust, paint, grease, oil, rust, or any contaminant other than water.
- C. Pre-test the materials under field conditions at the grout pocket and camber strip anticipated to determine whether subsequent cracking will occur.
  - 1. The corrective action will be at the discretion of the Engineer.
  - 2. Proceed with grouting process at the direction of the Engineer.
- D. Saturate surface dry (SSD) all surfaces receiving structural non-shrink grout.
- E. Apply product following manufacturer's recommendations preparation and installation.
- F. Cure structural non-shrink grout per manufacturer's recommendation.
  - 1. Contact the manufacturer's representative for advice on how to reduce heat such as wet curing or adding retarding admixture if the heat of hydration is excessive.
- G. Use a mix design in accordance with the requirements of Section 03055 if adding more than 15 lb of coarse aggregate (size No. 8) or larger per 50 lb bag of structural non-shrink grout.
- H. Place structural non-shrink grout in the girder camber strips and shear stud blockouts in a continuous operation within a panel after all panels and shear studs are fully installed.
- I. Form the girder camber strips as shown on the plans after shear studs are installed at the locations shown on the plans.
  - 1. Grout the shear stud blockouts and girder camber strips using structural non-shrink grout.
- J. Do not allow voids in the grout for the girder camber strips and shear stud blockouts.

- K. Do not apply superimposed dead loads or live loads to the precast concrete deck panels until the structural non-shrink grout in the shear stud blockouts and the girder camber strips have been in place for two hours.

END OF SECTION

**Supplemental Specification  
2005 Standard Specification Book**

**SECTION 03390**

**CONCRETE CURING**

**Delete Section 03390 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Concrete curing materials and methods.

**1.2      REFERENCES**

- A.      AASHTO M 148: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- B.      AASHTO LRFD Bridge Construction Specifications
- C.      ASTM C 1315: Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

**1.3      SUBMITTALS**

- A.      Provide manufacturer's product data, specifications, and recommended installation instructions.

**PART 2      PRODUCTS**

**2.1      CURING COMPOUND FOR STRUCTURAL AND ARCHITECTURAL CONCRETE**

- A.      Meet AASHTO M 148, Type I D, Class A.

**2.2      CURING COMPOUND FOR PORTLAND CEMENT CONCRETE PAVEMENT**

- A.      Meet AASHTO M 148, Type 2, Class B.

## **2.3 CURING COMPOUND FOR LEAN CONCRETE BASE COURSE**

- A. Use a curing compound with a wax base.
- B. Meet AASHTO M 148, Type 2, Class A.

## **2.4 CURING COMPOUND FOR CONCRETE BARRIER**

- A. Meet ASTM C 1315, Type 1, Class A.

# **PART 3 EXECUTION**

## **3.1 PREPARATION**

- A. Verify concrete surfaces are ready for curing.
  - 1. Complete all patching or surface finishing before applying compound.
- B. Follow product manufacturer's recommendations for preparing surfaces.
- C. Keep surfaces moist until the curing compound is applied.
- D. Do not dilute or alter the compound.

## **3.2 CURING STRUCTURES**

- A. Bridge Decks and Approach Slabs.
  - 1. Apply membrane-curing compound at the manufacturer's recommended rate so that no portion of the deck or approach slab is exposed to the atmosphere for more than 20 minutes after the tining or finishing operation.
  - 2. Apply membrane-curing compound at a uniform rate of 100 ft<sup>2</sup>/gal.
  - 3. Work bridge to follow immediately after the finishing machine to allow application of the curing compound while the concrete is still plastic.
  - 4. As soon as the concrete is sufficiently set to support the materials, cover bridge decks, approach slabs, curbs, and parapet walls with material that retains moisture and does not prevent evaporation, such as cotton or burlap mats.
    - a. Secure the cotton or burlap mats to prevent wind or other forces from removing them.
    - b. Do not damage the finish.

5. Keep entire concrete damp continuously for ten days after placement. Do not erode or damage the surface.
- B. Other newly placed concrete: Use membrane-curing compound method.
  1. Keep surfaces moist until the curing compound is applied.
  2. Complete all patching or surface finishing before applying compound.
  3. Warm chilled compound that is too viscous to a maximum of 90 degrees F.
  4. Apply curing compound immediately after finishing operations are completed
  5. Spray the entire surface of the concrete with a membrane curing compound at a uniform rate of 100 ft<sup>2</sup>/gal.
  6. Immediately re-spray any portion damaged before the ten-day curing expires.

### **3.3 CURING CURB, GUTTER, FLATWORK, SIDEWALK, DRIVEWAY, AND OTHER MISC CONCRETE ITEMS (CONCRETE SLOPE PROTECTION)**

- A. Refer to this Section, article 3.2, paragraph B.

### **3.4 CURING PRESTRESSED CONCRETE**

- A. Cure following this Section, article 3.2, or article 3.10, until concrete has reached a strength of 4,000 psi or as designated on the plans.

### **3.5 CURING PRECAST CONCRETE BARRIER**

- A. Cure exposed surfaces immediately after finishing operations are completed.
  1. Apply the curing compound at a rate of 100 ft<sup>2</sup>/gal.
- B. After removing form, broom clean the surface of the barrier and apply two coats of curing compound.
  1. Apply the first coat at a rate of 100 ft<sup>2</sup>/gal.
  2. Allow the first coat to dry thoroughly before applying the second coat.
  3. Apply the second coat at a rate of 200 ft<sup>2</sup>/gal.
- C. Immediately repair any damage to the compound film occurring until seven days after the initial application at no additional cost to Department.

### **3.6 CURING CAST IN PLACE CONCRETE BARRIER**

- A. Cure immediately after finishing operations are complete.

- B. Apply two coats of curing compound following this Section, article 3.5.
- C. Immediately repair any damage to the compound film occurring until seven days after the initial application at no additional cost to Department.

### **3.7 CURING PRECAST NOISE WALL**

- A. Apply curing compound to all exposed surfaces immediately after finishing and when forms are removed.
  - 1. Apply curing compound at a uniform rate of 100 ft<sup>2</sup>/gal.
- B. For exposed aggregate finishes.
  - 1. Cover surface of exposed aggregate noise wall panels with a moisture barrier or membrane immediately after initial finishing operations are completed.
  - 2. Leave cover in place until final finishing operations (exposed aggregate) are performed.
  - 3. Immediately apply curing compound upon removal of cover and completion of final finishing operations.
  - 4. Apply curing compound at a uniform rate of 100 ft<sup>2</sup>/gal.
- C. Immediately repair any damage to the compound film occurring until seven days after the initial application at no additional cost to Department.

### **3.8 CURING LEAN CONCRETE BASE COURSE**

- A. After finishing operations are complete, apply curing compound.
  - 1. Spray entire exposed area (top and sides) at a rate of 200 ft<sup>2</sup>/gal.
  - 2. Hand spray on small areas and areas inaccessible to mechanical spraying equipment.
  - 3. Provide complete coverage with curing compound at edges, corners, sides, and rough spots.
- B. Damage to the film of curing compound occurring within 72 hours of application must be repaired immediately at no additional cost to Department.

### **3.9 CURING PORTLAND CEMENT CONCRETE PAVEMENT**

- A. Apply curing compound according to manufacturer's recommendations.
- B. Thoroughly mix the compound and uniformly disperse the pigment before and during application.

- C. Apply compound to the entire pavement surface and exposed edges immediately after completing finishing operations:
  - 1. Apply the curing compound in two approximately equal applications.
  - 2. Apply the second application in the opposite longitudinal direction as the first at a combined application rate equal to 100 ft<sup>2</sup>/gal.
  - 3. Allow at least 30 minutes between applications.
  - 4. Small and irregular areas and areas inaccessible to mechanical spraying equipment will be hand sprayed.
- D. Stop paving operations if the application of the compound behind the paving machine is delayed until the problem is resolved.
  - 1. Keep the pavement moist with water until the compound application process is resumed.
  - 2. Apply the water in a fog-mist spray without damaging the pavement surface texture.
- E. Immediately repair any damage to the compound film occurring until seven days after the initial application at no additional cost to Department.

### **3.10 STEAM OR RADIANT HEAT CURING**

- A. Steam or radiant heat curing may only be used for products manufactured in an established plant.
- B. Provide a complete steam or radiant heat curing system approved by the Engineer, including 24 hour temperature control and monitoring devices, and a suitable enclosure to contain live steam and minimize moisture and heat losses.
- C. Comply with the requirements of the AASHTO LRFD Bridge Construction Specifications, section 8.11.
  - 1. Do not apply heat until the concrete has set. Wait four to six hours if retarders are used. If no retarders are used, wait two to four hours.
  - 2. Heat may be applied to maintain a minimum temperature of 50 degrees F within the curing enclosure while waiting for the concrete to set.
  - 3. Maintain 100 percent relative humidity in the curing enclosure.
  - 4. Do not apply heat directly on the concrete or cause localized high temperatures.
  - 5. When applying heat, increase the ambient air temperature at a rate not to exceed a 40 degrees F per hour until a temperature range of 140 degrees to a maximum 160 degrees F is reached.
  - 6. Maintain the temperature range until the concrete has reached the specified strength.

7. When discontinuing heat, decrease the ambient air temperature at a rate not to exceed a 40 degrees F per hour until reaching a temperature of not more than 20 degrees F above the air temperature to which the concrete will be exposed.
8. For prestressed members, transfer stressing force to the concrete immediately after heat curing has ceased.

END OF SECTION

**Supplemental Specification  
2005 Standard Specification Book**

**SECTION 03392**

**PENETRATING CONCRETE SEALER**

**Delete Section 03392 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Materials and procedures for applying protective penetrating concrete sealer.

**1.2      REFERENCES**

- A.      AASHTO T 242: Standard Test Method for Frictional Properties of Paved Surfaces Using a Full-Scale Tire

**1.3      SUBMITTALS**

- A.      Manufacturer's product data, specifications, and recommended installation instructions.
- B.      Certification of a minimum Friction Number of 40 for at least 90 percent of friction numbers. Refer to AASHTO T 242.
  - 1.      Applies only to traveled way surfaces where the plans require sealer.

**PART 2      PRODUCTS**

**2.1      PENETRATING CONCRETE SEALERS**

- A.      Choose from the following list:
  - 1.      Silane
  - 2.      Siloxane
  - 3.      Silicate
  - 4.      Siliconate
  - 5.      Organo Silane Ester
  - 6.      Styrene Acrylic Copolymer
  - 7.      Organo Siloxane

8. Alkylalkoxy Siloxane
9. Alkylalkoxy Silane

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Keep surfaces dry and free of laitance, dirt, dust, paint, grease, oil, rust, and other contaminants.
- B. Remove any curing compound from the surface of the concrete before applying penetrating sealer.
- C. Use one of the following cleaning methods:
  1. Hydroblasting - 700 psi min.
  2. Shotblasting
  3. Sandblasting
  4. Etching
- D. Keep concrete surface matrix intact without exposing any large aggregate.
- E. Cure concrete for 28 days before sealer application.
- F. Obtain approval from the Engineer before applying material.

### **3.2 APPLICATION**

- A. Application Rate:
  1. Apply according to manufacturer's recommendations for each of the following surfaces:
    - a. Horizontal
    - b. Vertical
    - c. Overhead
- B. Application Drying Time: Select a sealer with maximum drying time of 1½ hours.
- C. Do not apply sealer to Portland Cement Concrete Pavement (PCCP). When plans specify application to other traveled way surfaces such as approach slabs, bridge decks, etc., meet the minimum Friction Number of 40 for at least 90 percent of friction numbers. Refer to AASHTO T 242.

END OF SECTION

**Supplemental Specification  
2005 Standard Specification Book**

**SECTION 05120**

**STRUCTURAL STEEL**

**Delete Section 05120 and replace with the following:**

**PART 1      GENERAL**

**1.1      SECTION INCLUDES**

- A.      Materials and procedures for erecting structural metals.

**1.2      RELATED SECTIONS**

- A.      Section 05822: Bearings
- B.      Section 09972: Painting for Structural Steel

**1.3      REFERENCES**

- A.      AASHTO M 111: Standard Specification for Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
- B.      AASHTO M 164: Standard Specification for High-Strength Bolts for Structural Steel Joints
- C.      AASHTO M 270: Standard Specification for Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
- D.      AASHTO M 291: Standard Specification for Carbon and Alloy Steel Nuts
- E.      AASHTO M 293: Standard Specification for Hardened Steel Washers
- F.      AASHTO LRFD Bridge Construction Specifications
- G.      AASHTO/AWS D1.5 Bridge Welding Code

- H. ASTM F 606: Standard Specification for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets
- I. ASTM F 959: Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use With Structural Fasteners
- J. American Institute of Steel Construction (AISC)
- K. Society for Protective Coatings (SSPC)
- L. UDOT Quality Management Plan
- M. UDOT Steel and Concrete Construction Manual

#### **1.4 SUBMITTALS**

- A. Manufacturer's certificate of compliance for nut proof load tests as specified. AASHTO M 291.
  - 1. Certificate must show corresponding lot numbers appearing on the shipping package, certification, test location, time and date, and results of all testing.
  - 2. Include rotational capacity and proof load test results.
- B. Copy of certified mill test reports (MTR) for all fabricated structure materials, seven calendar days before fabrication, including materials manufactured outside the United States. Clearly indicate country of origin on MTR.
- C. Shop Drawings: Submit five copies of shop detail drawings for all fabricated materials.
  - 1. Submit five sets on 11 inch x 17 inch sheets with the Department project designation data, structure number, drawing number, and sheet number in the lower right corner.
  - 2. All details are subject to modification or approval.
  - 3. Do not order materials or begin work until receiving final approval of the shop detail drawings.
  - 4. Do not deviate from the approved shop drawings unless authorized in writing. Contractor is responsible for costs incurred due to faulty detailing or fabrication.
  - 5. Engineer reserves the right to retain these drawings up to 14 calendar days unless they are submitted electronically in which case seven calendar days will apply, without granting an increase in the number of working days for the project. This right applies each time the drawings are submitted.

- D. Erection Plan for Bridges: Submit an Erection Plan 10 days prior to beginning erection of structural steel members for documentation purposes only. The Engineer will not approve the Erection Plan. Fully illustrate the proposed method of erection. Provide complete details of the process including, but not limited to:
1. Temporary supports, bracing, guys, dead-men, lifting devices, connection details and attachments to bridge members.
  2. The schedule and sequence of erection, location of cranes, crane capacities, location of lifting points on the bridge members, member weights, and any other assumed loads.
  3. Complete details for all anticipated phases and conditions during erection.
  4. Minimum number of primary members, secondary members, connections, etc. that must be installed and properly connected to provide structural integrity and stability.
  5. Supporting calculations in accordance with the current edition of the AASHTO LRFD Bridge Design Specifications to demonstrate that factored resistances are not exceeded and that member capacities and final geometry will be correct.
  6. Incorporate into the plan the requirements from this Section article 3.6.
  7. Bolting procedure for field splices and diaphragms on that meets American Institute of Steel Construction (AISC) Manual of Steel Construction requirements.
  8. A professional engineer, licensed in the State of Utah, will approve, sign, and seal the Erection Plan and supporting calculations. The professional engineer must approve any and all changes to the Erection Plan prior to implementation.
  9. UDOT prefers an AISC Advanced Certified Steel Erector (ACSE)

## **PART 2 PRODUCTS**

### **2.1 STRUCTURAL METALS**

- A. As specified unless otherwise indicated. Follow AASHTO LRFD Bridge Construction Specifications, Section 11.3.

### **2.2 HIGH TENSILE STRENGTH NUTS, BOLTS, AND WASHERS**

- A. Use bolts, nuts and washers displaying the manufacturer's markings.
- B. Bolts: As specified in AASHTO M 164 with the following modifications:
1. Maximum tensile strength:
    - a. 150 ksi for bolts 1 inch or less in diameter
    - b. 120 ksi for bolts larger than 1 inch in diameter

- C. Nuts:
  - 1. As specified in AASHTO M 291 or AASHTO M 293.
  - 2. Use heat-treated Grades DH and 2H, except use Type DH3 nuts when Type 3 bolts are called for.
- D. Washers: As specified in AASHTO M 293.
- E. Load Indicator Washers: As specified in ASTM F 959.
- F. Certification of Bolts and Nuts (Black and Galvanized): Subject to the Rotational Capacity Test, Section 6.3 AASHTO M 164 and the following requirements.
  - 1. Go through twice the required number of turns (from snug tight condition) in a Skidmore-Wilhelm Calibrator or equivalent tension measuring device without stripping or failure as specified.
  - 2. Maximum recorded tensile strength must be equal to or greater than 1.15 times the required fastener tension as specified.
  - 3. Measured torque necessary to produce the required fastener tension must not exceed the value obtained by the following equation:
 

	Torque	≤	0.25 PD
Where:	Torque	=	Measured Torque (foot-lbs)
	P	=	Measured Bolt Tension (lbs)
	D	=	nominal diameter (feet)
  - 4. Bolts and nuts require proof load tests as specified in ASTM F 606, Method 1 (Proof Load).
  - 5. Bolts and nuts require wedge tests as specified in AASHTO M 164, Section 6.2.
- G. Foreign Materials:
  - 1. Use foreign manufacturers who have previously established the ability to furnish material uniformly and consistently within the specifications.

## 2.3 BEARINGS

- A. Refer to Section 05822.

## **2.4 FABRICATION**

- A. Fabricate as specified in AASHTO LRFD Bridge Construction Specifications Section 18, UDOT Steel and Concrete Construction Manual, and Steel Quality Management Plan. AASHTO/AWS D 1.5.
- B. If steel structure is to be part of a bridge structure, the fabricator must have AISC, Major Steel Bridge (CBR) Certification.
  - 1. MSB (CBR) Certification not required for railings, grates, grate frames, and drain pipes. These items may be fabricated with Simple Steel Bridge Structures (SBR) Certification.

## **2.5 APPROACH SLAB DRAIN ANGLES AND GRATE**

- A. AASHTO M 270, Grade 36.
- B. Hot-dip galvanize after fabrication. AASHTO M 111.

## **PART 3 EXECUTION**

### **3.1 INSPECTION**

- A. Notify Engineer immediately upon placing the fabrication order to allow time for shop inspection.
  - 1. Do not begin fabrication until arrangements for shop inspection have been made.
  - 2. Facilitate inspection procedures on site and supply personnel as needed to properly inspect the work.
- B. Allow authorized inspectors free and immediate access to all parts of the plant.
- C. Furnish facilities for inspection of material and workmanship in the mill and shop.
- D. The Inspector has the authority to reject any materials or work not meeting the specifications.
  - 1. Material accepted by the Inspector may be rejected if found defective at a later time.
  - 2. Replace or correct rejected material at no additional cost to the Department.
  - 3. Contractor may appeal disputes with the Inspector to the Engineer for a final decision.

### 3.2 INSTALLING HIGH STRENGTH BOLTS

- A. Testing:
  - 1. Provide a Skidmore-Wilhelm calibrator or other acceptable bolt tension-indicating device for bolt testing at the job site.
  - 2. Use direct-tension indicators with solid plates when the fastener-grip length is too short to be tested in a Skidmore-Wilhelm calibrator.
  - 3. Check the direct-tension indicators in a Skidmore-Wilhelm calibrator using bolts of sufficient length before using.
- B. Test the installed bolt/nut/washer assembly periodically to verify compliance.
- C. Use direct-tension indicator washers as specified to tighten high strength bolts.
  - 1. ASTM F 959.
  - 2. Tighten bolts according to the manufacturer's methods and procedures or as modified by Engineer.
  - 3. Tighten the fastener to reduce the gap to 0.005 inch or less regardless of which element is turned for tightening.
- D. Install bolts as specified in AASHTO LRFD Bridge Construction Specifications, Section 11.5.6.4 and use the following procedure.
  - 1. Complete the *Bolted Field Splice Certification* form at the end of this section as bolt tightening progresses.
  - 2. Place direct-tension indicator washer where the washers will not be embedded in concrete.
  - 3. Use drift pins to align bolt holes and maintain dimensions and camber of the member.
  - 4. Insert bolts in open holes with washers as specified by the manufacturer, and hand tighten.
  - 5. Tighten at least 50 percent of the bolts (more as required) to approximately  $\frac{1}{2}$  final tension to draw all plies of the connection into firm contact. Do not tighten any bolts to indicated full tension at this time.
  - 6. Remove drift pins and replace with bolts.
  - 7. Tighten bolts progressively from fixed or rigid points to the free edges.
  - 8. For field splices and diaphragms fully tighten 50 percent of bolts. Remaining bolts are to be snug tight before release of crane.
  - 9. Tighten all bolts to full tension.
- E. Store the bolts and nuts in the original containers until used.
  - 1. Protect from dirt and moisture.
  - 2. Remove only as many fasteners from protected storage as can be tightened during a work shift, and return unused fasteners to protected storage at the end of each work shift.

3. Clean and re-lubricate fasteners that accumulate rust or dirt resulting from site conditions. Use manufacturer recommended lubricant.

### **3.3 WELDING**

- A. As specified in AASHTO/AWS D1.5, except as modified by the contract.
- B. Field welds must meet the same requirements as shop welds, including inspection by the Department.
- C. When AISC CBR Certification is required for the fabrication of the element, do all field welding under the certification.
- D. Comply with welding procedures and inspection requirements. Refer to UDOT Steel and Concrete Construction Manual.
- E. Welding operators must be pre-qualified. Comply with UDOT Steel and Concrete Construction Manual.

### **3.4 BEARINGS AND ANCHORAGES**

- A. Do not place masonry bearing plates upon bridge seat bearing areas that are improperly finished, deformed, or irregular. Set bearing plates level in exact position with full even bearing.
- B. Locate the anchor bolts in relation to the slotted holes in expansion shoes to correspond with the temperatures at the time of erection. Adjust nut-gap on anchor bolts as shown at the expansion ends to permit free movement of the span.
- C. Form bridge seat bearing areas and place anchor bolts according to details shown.
- D. Place so that identification mark is visible after completion of the bridge.
- E. Do not weld exterior plates of bearings unless at least 1.5 inch of steel exists between the weld and the Elastomer.
  1. Do not subject the Elastomer or the bond to temperatures higher than 400 degrees F.

### **3.5 SURFACE PREPARATION STEEL**

- A. For surface preparation for painting of non weathering steel, refer to Section 09972.

- B. Weathering steel:
1. Construct so that erection marks on the steel are not visible after the structure is completed.
  2. Commercially blast all surfaces according to the specification standards. Meet SSPC-SP 6.
  3. Commercially blast the following surfaces to meet SSPC-SP 10:
    - a. Underside of the exterior portion of the top flange of fascia girders, and underside of bottom flange of all girders.
    - b. The exterior portion of web of fascia girders.
    - c. Top side and outside edge of the exterior portion of the bottom flange of fascia girders.
    - d. All welded surfaces
  4. Develop even patinas at completion of welding repair and after surface has been accepted by engineer.
  5. Clean girders of any debris after deck concrete is placed
  6. Redevelop patina as needed.

### **3.6 ERECTION**

- A. Maintain responsibility for all aspects of girder erection during all stages of construction, including the protection of structural steel members, the workers, and the traveling public.
- B. Erect structural steel members in compliance with the Erection Plan and in a manner that prevents damage to all elements of the structure.
- C. During erection, temporarily support, anchor and brace primary members such as beams and girders in a manner that will produce the proper alignment and camber in the completed structure.
1. Install cross frames and diagonal bracing as necessary to provide stability and assure correct geometry.
  2. Provide temporary bracing or stiffening devices if necessary during any stage of erection.
  3. Support, anchor and brace all erected superstructure members as detailed in the Erection Plan before allowing traffic under the bridge.
- D. Design temporary supports and falsework in accordance with the current edition of the AASHTO LRFD Bridge Construction Specifications, Section 3 "Temporary Works."
- E. Accurately assemble all parts as specified in the contract documents or erection drawings. Follow any match-marks.
- F. Provide any additional materials that are required to keep both the temporary and final stresses within the allowable limits used in design.

- G. Carefully handle materials so that no parts will be bent, broken, or otherwise damaged.
  - 1. Do not injure or distort the members when hammering.
- H. Before the members are assembled, clean bearing surfaces and surfaces that will be in permanent contact.
- I. Do not open traffic under a partially-erected bridge superstructure, unless allowed in the Erection Plan or approved by the professional engineer who approved, signed, and sealed the Erection Plan.

END OF SECTION

Bolted Field Splice Certification follows.

## Bolted Field Splice Certification

Consecutively number splices looking stations ahead and increasing from left to right. Copy this page as required. Initial the appropriate box to certify that the bolt tightening has been done in accordance with the specifications.

Do not perform final tightening until the inspector certifies that plates are drawn into full contact. Do not place concrete deck until the inspector has certified that all bolts are properly tightened. Prior to the final inspection, send a completed copy of this form to the State Bridge Engineer, 4501 South 2700 West, Salt Lake City, UT 84119.

Project Number

Structure Number

Splice No.	Top Flange		Web		Bottom Flange	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.005 inch.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials

Splice No.	Top Flange		Web		Bottom Flange	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.005 inch.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials

Splice No.	Top Flange		Web		Bottom Flange	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.005 inch.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials